

DAFTAR PUSTAKA

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Program Perhitungan Rantai dengan Menggunakan Visual Basic

Private Sub Command1_Click()

Dim TauB As Single 'KEKUATAN TEGANGAN TARIK
Dim Rs As Single 'TEGANGAN GESER YANG DILJINKAN
Dim P As Single 'TEKANAN SPESIFIK YANG DILJINKAN

'VARIABEL UNTUK FAKTOR GESEKAN

Dim f As Single

Dim Lttotal As Single 'PANJANG KONVEYOR
Dim RZ As Single 'KEKUATAN TEGANGAN TARIK BAHAN PLAT RANTAI
Dim TauBB As Single 'KEKUATAN TEGANGAN TARIK BAHAN BAUT

ATTACHMENT

Dim Rsb As Single 'KEKUATAN TEGANGAN GESER BAHAN BAUT

ATTACHMENT

Dim CK As Single 'FAKTOR BEBAN KONVEYOR

Dim RB As Single

Dim RsAKSEN As Single

Dim Tau As Single

Dim M As Single 'PERBANDINGAN d0:d1

Dim Pth As Single '

Dim b3 As Single 'TEBAL MAXIMAL GIGI SPROKET

Dim Tau1 As Single

Dim RbbAKSEN As Single

Dim pDOUBLEAKSEN As Single

Dim RzAKSEN As Single

Dim ZZ As Single

Dim ZIGMAz As Single

Dim ZIG As Single

Dim HHB As Single

Dim HB As Single

Dim Phi As Single

Dim TTT As Single

Dim ASth As Single

Dim SSS As Single

NB1 = txtINPUT(18).Text

NB2 = txtINPUT(21).Text

NB3 = txtINPUT(23).Text

NB4 = txtINPUT(25).Text

NB5 = txtINPUT(28).Text

Phi = 22 / 7

f = F2 / F1

T1 = Qo * L1 * F1

T2 = T1 * KC1

T3 = Qo * (L2 * F1 - mt_H) + T2

T4 = T3 * KC2

If T3 < 0 Then T4 = 0



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T5 = Qo * L3 * F1
If T5 = 0 Then T5 = T3
T6 = 1.1 * T5 'TEGANGAN STATIK MAX PADA DRIVEN SPROKET'
T7 = (Qo + Q * f) * L4 * F1 + T6
T8 = T7 * KC3
T9 = Q * (L5 * F1 * f + rnt_H) + Qo * (L5 * F1 + rnt_H) + T8
T10 = T9 * KC4
T11 = (Qo + Q * f) * L6 * F1 + T10
Ltotal = L1 + (L2 ^ 2 + rnt_H ^ 2) ^ 0.5 + L3
If Ltotal < 25 Then CK = 2
If Ltotal >= 26 And Ltotal <= 60 Then CK = 1.5
If Ltotal > 60 Then CK = 1
Sdyn = 6 * Phi ^ 2 * rnt_V ^ 2 * (tAKSEN / 1000) * (Q + CK * Qo) * Ltotal / ((Z *
(tAKSEN / 1000)) ^ 2 * 9.81) 'BEBAN DYNAMIK RANTAI'
RbAKSEN = TauB / 5
Sth = T11 + Sdyn 'TEGANGAN TEORITIS'
e = C + 2 * rnt_a
ASth = Abs(Sth) / 2
SSS = 16 / Phi
D0 = (SSS * ASth / RbAKSEN) ^ (1 / 3) 'DIAMETER MINIMAL PIN'
RsAKSEN = Rs / 5
Tau = (Sth / (Phi * D0 ^ 2))
If Tau > RsAKSEN Then D0 = (Sth / (Phi * RsAKSEN)) ^ 0.5 'd0=DIAMETER PIN'
LL = C + 4 * rnt_a + 3

```

'MENGHITUNG BUSH'

Dim masukan As String

RbbAKSEN = RBB / 4

TTT = T1

If T1 = 0 Then

TTT = T4

End If

M = 0.8

Do

D1 = D0 / M 'DIAMETER BUSH

Pth = T11 - TTT + Sdyn

b3 = 0.9 * C

Tau1 = 1.27 * (Pth / 2) * (2 * (C + rnt_a) - b3) / (D1 ^ 3 * (1 - M ^ 4))

If Tau1 > RbbAKSEN Then

M = M - 0.0005 'CSng(InputBox("MASUKKAN NILAI M YANG BARU",

"INPUT M", Str(M)))

End If

Loop While Tau1 > RbbAKSEN

DV = (D1 + D0) / 2

'MENGHITUNG PLAT RANTAI

R = 0.5 * DV 'JARI-JARI LOBANG PLAT DALAM

'PlatRantai.DiameterLobangDalam = D1 'JARI-JARI LOBANG PLAT DALAM

pDOUBLEAKSEN = Sth / (8 * rnt_a * R)

RzAKSEN = Rz / 5

'Rz:KEKUATAN TEGANGAN TARIK BAHAN YANG DIJINKAN



'Rluar = R * ((RzAKSEN + pDOUBLEAKSEN) / (RzAKSEN - pDOUBLEAKSEN)) ^
0.5 'JARI_JARI LUAR LENGKUNG PLAT
rnt_b = Sth / (4 * rnt_a * RzAKSEN) + DV 'LEBAR MINIMAL PLAT RANTAI

'MENGHITUNG BAUT PADA ATTACHMENT

ZZ = TauBB / 5
Da = (((Q + Qo) * 4 * Sin(rnt_ALFA * Phi / 180)) / (Phi * ZZ)) ^ 0.5

'MENGHITUNG SPROKET

DDO = tAKSEN / (Sin(Phi / Z))
DR = DDO - 0.2 * tAKSEN
EE = 0.04 * Z * (ZIG) ^ (1 / 3)
RR = 0.5 * D1
RRR = tAKSEN - (EE + RR)
DE = DDO + 0.5 * D1 + 6
DB = DDO - D1
B1 = 0.9 * C
B2 = 0.83 * B1

HHB = (Abs(Pth) / (0.1 * B1 * D1)) ^ 0.5
If HHB > HB Then 'GANTI BAHAN DENGAN HB LEBIH BESAR
End If
Me.Hide
rnt_frmGAYA.Show

End Sub

Private Sub Command2_Click()
Me.Hide

rnt_frmINPUTRANTAI.Show
End Sub

Private Sub Form_Activate()
txtOUTPUT(31).Text = Sth
txtOUTPUT(32).Text = T11
txtOUTPUT(33).Text = Sdyn
txtOUTPUT(34).Text = T6
txtOUTPUT(35).Text = T3

End Sub

Private Sub Form_Activate()
txtOUTPUTPIN(1).Text = NB1
txtOUTPUTPIN(2).Text = D0
txtOUTPUTPIN(3).Text = LL
txtOUTPUTBUSH(4).Text = NB2
txtOUTPUTBUSH(5).Text = D0
txtOUTPUTBUSH(6).Text = D1
txtOUTPUTBUSH(7).Text = e
txtOUTPUTPLAT(8).Text = NB3
txtOUTPUTPLAT(9).Text = DV
txtOUTPUTPLAT(10).Text = D0
txtOUTPUTPLAT(11).Text = rnt_b
txtOUTPUTPLAT(12).Text = tAKSEN
txtOUTPUTPLAT(13).Text = rnt_a
txtOUTPUTPLAT(14).Text = R
txtOUTPUTATTACHMENT(26).Text = NB5
txtOUTPUTATTACHMENT(27).Text = Da

End Sub



Private Sub Form_Activate()

txtOUTPUTSPROKET(15).Text = tAKSEN

txtOUTPUTSPROKET(16).Text = DDO

txtOUTPUTSPROKET(17).Text = DR

txtOUTPUTSPROKET(18).Text = RR

txtOUTPUTSPROKET(19).Text = RRR

txtOUTPUTSPROKET(20).Text = DE

txtOUTPUTSPROKET(21).Text = DB

txtOUTPUTSPROKET(22).Text = B1

txtOUTPUTSPROKET(23).Text = B2

txtOUTPUTSPROKET(24).Text = NB4

txtOUTPUTSPROKET(25).Text = EE

End Sub



Program Pemilihan Roda Gigi dengan Menggunakan Visual Basic

DEVINISI VARIABEL DAN PROSES

```
Private Sub Command1_Click()  
On Error GoTo TerjadiError  
Screen.MousePointer = 11  
For i = 0 To 5  
    NB(i) = txtNB(i).Text  
    S0(i) = CSng(txtR(i).Text)  
    D(i) = CSng(txtMJ(i).Text)  
    H(i) = CSng(txtH(i).Text)  
    HB(i) = CSng(txtHB(i).Text)  
    K01(i) = CSng(txtS(i).Text)  
  
Next i  
YS = CSng(tYS(0).Text)  
YG = CSng(tYS(1).Text)  
  
For i = 0 To 5  
    YH(i) = (HB(i) / H(i)) ^ 2  
    MM = 716 * N1 / nn1  
    KD(i) = YG * YH(i) * YS * YV * K01(i)  
    BZ(i) = 0.35 * KD(i) * ii / (CS * SG * (ii + 1))  
    b(i) = 10 ^ 6 * N1 * (i + 1) ^ 2 / (2.8 * nn1 * A ^ 2 * BZ(i))  
    W1(i) = 0.25 * 3.14 * DK1 ^ 2 * b(i) * D(i) / 10 ^ 6  
    W2(i) = 0.25 * 3.14 * DK2 ^ 2 * b(i) * D(i) / 10 ^ 6  
    W(i) = W1(i) + W2(i)  
  
Next i  
Wterkecil = W(0)  
For i = 1 To 5  
    If Wterkecil > W(i) Then  
        Wterkecil = W(i)  
        POSISI = i  
    End If  
Next i  
  
Private Sub Command1_Click()  
'On Error GoTo Terjadierror  
Screen.MousePointer = 11  
ESP = CSng(txtSS(0).Text)  
E1 = CSng(txtSS(1).Text)  
E2 = CSng(txtSS(2).Text)  
CT = CSng(txtSS(3).Text)  
QK1 = CSng(txtSS(4).Text)  
QK2 = CSng(txtSS(5).Text)  
KT = CSng(txtSS(6).Text)  
Mtest = CSng(txtSS(7).Text)  
For i = 0 To 5  
    YH(i) = (HB(i) / H(i)) ^ 2  
    MM = 716 * N1 / nn1  
    KD(i) = YG * YH(i) * YS * YV * K01(i)  
    BZ(i) = 0.35 * KD(i) * ii / (CS * SG * (ii + 1))  
    b(i) = 10 ^ 6 * N1 * (i + 1) ^ 2 / (2.8 * nn1 * A ^ 2 * BZ(i))
```



Do

DoEvents

Do

DoEvents

Do

DoEvents

Do

DoEvents

$$W1(i) = 0.5 * 3.14 * DK1^2 * b(i) * D(i) / 10^6$$

$$W2(i) = 0.35 * 3.14 * DK2^2 * b(i) * D(i) / 10^6$$

$$W(i) = W1(i) + W2(i)$$

$$EN = E1 + E2$$

$$YB = 1$$

$$nn2 = nn1 / ii$$

$$ALFA = ALF * Phi / 180$$

$$FE = GE * (3 + 0.3 * M + 0.2 * D01^0.5)$$

$$U = 2000 * (716 * N1 / (nn1 * Db1))$$

$$UU(i) = U / b(i)$$

$$Udyn(i) = 0.3 * UU(i) * CS + FE$$

$$CD(i) = 1 + Udyn(i) / (UU(i) * CS * (ESP + 1))$$

$$BB(i) = U / (Db1 * b(i))$$

$$BW(i) = BB(i) * CS * CD(i) * CT$$

$$QE1 = 1.4 / (EN + 0.4)$$

$$EW = 1 + (EN - 1) * (M + V / 4) / (M + FE / 6)$$

$$QE2 = 1.4 / (EW + 0.4)$$

$$QW1 = QK1 * QE1$$

$$QW2 = QK2 * QE2$$

$$YC = 1 / (\sin(ALFA) * \cos(ALFA))$$

$$E1W = E1 * EW / EN$$

$$YE = 1 - 2 * 3.14 * (1 - E1W) / (Z1 * nn1 * 0.364)$$

$$YW1 = YC / YE$$

$$YW2 = YC$$

$$EE1 = R1 * (((1 + HK1 / R1)^2 - (\cos(ALFA))^2)^{0.5} - \sin(ALFA))$$

$$YF = 12.7 * (ii + 1)^2 * (1 + (EE1 / 10)^4) * M^{0.5} / (Db1 * ii)$$

$$KD1(i) = KD(i)$$

$$KD2(i) = KD1(i)$$

$$SB1(i) = S0(i) / (BW(i) * Z1 * QW1 * CS)$$

$$\text{If } SB1(i) \leq 1.25 \text{ Then } b(i) = b(i) + 1$$

Loop While SB1(i) <= 1.25

$$SB2(i) = S0(i) / (BW(i) * Z1 * QW2 * CS)$$

$$\text{If } SB2(i) \leq 1.25 \text{ Then } b(i) = b(i) + 1$$

Loop While SB2(i) <= 1.25

$$SG1(ii) = KD1(i) * ii / (BW(i) * YW1 * CS * (ii + 1))$$

$$\text{If } SG1(ii) \leq 1.25 \text{ Then } b(i) = b(i) + 1$$

Loop While SG1(ii) <= 1.25

$$SG2(ii) = KD2(i) * ii / (BW(i) * YW2 * CS * (ii + 1))$$

$$\text{If } SG2(ii) \leq 1.25 \text{ Then } b(i) = b(i) + 1$$

Loop While SG2(ii) <= 1.25

DoEvents

Next i



Wterkecil = W(0)

For i = 1 To 5

If Wterkecil > W(i) Then

Wterkecil = W(i)

POSISI = i

End If

Next i

SF = KT * ii / (BW(POSISI) * YC * YF * CS * (ii + 1))

LH1 = 167000 * KD1(POSISI) * SG1(POSISI) ^ 2 / nn1

LH2 = 167000 * KD2(POSISI) * SG2(POSISI) ^ 2 / nn2

End Sub

Private Sub Command1_Click()

Dim YV1 As Single

Screen.MousePointer = 11

If IsianBenar Then

N1 = CSng(T(0).Text)

nn1 = CSng(T(1).Text)

Z1 = CSng(T(2).Text)

ii = CSng(T(3).Text)

M = CSng(T(4).Text)

ALF = CSng(T(5).Text)

CS = CSng(T(6).Text)

SG = CSng(T(7).Text)

nn2 = nn1 / ii

Phi = 22 / 7

Z2 = Z1 * ii

D01 = Z1 * M

D02 = Z2 * M

A = 0.5 * M * Z1 * (ii + 1)

DK1 = (Z1 + 2) * M

DK2 = (Z2 + 2) * M

HK1 = M

V = 3.14 * D01 * nn1 / 60000

Db1 = D01

Db2 = D02

DF1 = (Z1 - 2.5) * M

DF2 = (Z2 - 2.5) * M

YV1 = 1 + (8 / V) ^ 2

YV = 0.7 + (0.6 / YV1)

V1 = 100 / (V ^ 0.4)

R1 = D01 / 2

Screen.MousePointer = 0

Me.Hide

rdgfrmOUT_RODA_GIGI.Show

Else

Screen.MousePointer = 0

MsgBox "ISIAN ADA YANG TIDAK BENAR", vbOKOnly + vbCritical, "KESALAHAN"

T(0).SetFocus

End If

End Sub



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OUTPUT DATA RODA GIGI

Private Sub Form_Activate()

Screen.MousePointer = 11

With MSFlexGrid1

DoEvents

.MergeCells = 1

.MergeRow(1) = True

.MergeRow(3) = True

.MergeRow(11) = True

.MergeRow(43) = True

.ColWidth(0) = 4000

.ColWidth(2) = 4000

.Col = 0

.Row = 1

.Text = "Daya yang ditransmisikan"

.Row = 2

.Text = "Putaran poros "

.Row = 3

.Text = "Reduksi"

.Row = 4

.Text = "Sudut tekan"

.Row = 5

.Text = "Bahan roda gigi"

.Row = 6

.Text = " Ko"

.Row = 7

.Text = " Sigma"

.Row = 8

.Text = "Modul"

.Row = 9

.Text = "Jumlah gigi roda (Z) "

.Row = 10

.Text = "Diameter lingkaran jarak bagi (d0)"

.Row = 11

.Text = "Jarak sumbu poros"

.Row = 12

.Text = "Diameter lingkaran kepala (dk)"

.Row = 13

.Text = "Tinggi kepala"

.Row = 14

.Text = "Diameter lingkaran singgung (db)"

.Row = 15

.Text = "Diameter lingkaran kaki (df)"

.Row = 16

.Text = "Lebar gigi"

.Row = 17

.Text = "Torsi nominal pada roda (M)"

.Row = 18

.Text = "Gaya tangensial (U)"

.Row = 19

.Text = "Gaya tangensial persatuan lebar gigi (u)"

.Row = 20

.Text = "Gaya periperal dinamik perlebar gigi (Udyn)"

.Row = 21

.Text = "Kekuatan bahan terhadap tekanan permukaan (Kd)"



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```
.Row = 22
.Text = "Kecepatan tangensial (V)"
.Row = 23
.Text = "Intensitas beban nominal (B)"
.Row = 24
.Text = "Intensitas beban efektif (Bw)"
.Row = 25
.Text = "Faktor kejut (Cs)"
.Row = 26
.Text = "Faktor beban dinamis (Cd)"
.Row = 27
.Text = "Faktordistribusi beban (Ct)"
.Row = 28
.Text = "Faktor geometri (qk)"
.Row = 29
.Text = "Kontak ratio (e)"
.Row = 30
.Text = "Faktor tekananpermukaan"
.Row = 31
.Text = " Yc"
.Row = 32
.Text = " Yb"
.Row = 33
.Text = " Ye"
.Row = 34
.Text = " Yw"
.Row = 35
.Text = "Faktor tegangan padakaki gigi (qw)"
.Row = 36
.Text = "Faktor keamanan terhadappatah (Sb)"
.Row = 37
.Text = "Faktor-Faktor:"
.Row = 38
.Text = " Yg"
.Row = 39
.Text = " Yh"
.Row = 40
.Text = " Ys"
.Row = 41
.Text = " Yv"
.Row = 42
.Text = "Faktor keamanan terhadap pitting (Sg)"
.Row = 43
.Text = "Viskositas kinematikpelumas"
.Row = 44
.Text = "Umur roda gigi (Lh)"
.Row = 45
.Text = "Berat roda gigi"
.ColWidth(1) = 1500
.Col = 1
.Row = 0
.CellAlignment = 3
.Text = "Roda Gigi I"
.Row = 1
.CellAlignment = 3
```



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.Text = Str(N1)
 .Row = 2
 .CellAlignment = 2
 .Text = Str(nn1)
 .Row = 3
 .CellAlignment = 3
 .Text = Str(ii)
 .Row = 4
 .CellAlignment = 2
 .Text = Str(ALF)
 .Row = 5
 .CellAlignment = 2
 .Text = NB(POSISI)
 .Row = 6
 .CellAlignment = 2
 .Text = Str(K01(POSISI))
 .Row = 7
 .CellAlignment = 2
 .Text = Str(S0(POSISI))
 .Row = 8
 .CellAlignment = 2
 .Text = Str(M)
 .Row = 9
 .CellAlignment = 2
 .Text = Str(Z1)
 .Row = 10
 .CellAlignment = 2
 .Text = Str(D01)
 .Row = 11
 .CellAlignment = 3
 .Text = Str(A)
 .Row = 12
 .CellAlignment = 2
 .Text = Str(DK1)
 .Row = 13
 .CellAlignment = 2
 .Text = Str(M)
 .Row = 14
 .CellAlignment = 2
 .Text = Str(D01)
 .Row = 15
 .CellAlignment = 2
 .Text = Str(DF1)
 .Row = 16
 .CellAlignment = 2
 .Text = Str(b(POSISI))
 .Row = 17
 .CellAlignment = 2
 .Text = Str(MM)
 .Row = 18
 .CellAlignment = 2
 .Text = Str(U)
 .Row = 19
 .CellAlignment = 2
 .Text = Str(UU(POSISI))



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```

.Row = 20
.CellAlignment = 2
.Text = Str(Udyn(POSISI))
.Row = 21
.CellAlignment = 2
.Text = Str(KD(POSISI))
.Row = 22
.CellAlignment = 2
.Text = Str(V)
.Row = 23
.CellAlignment = 2
.Text = Str(BB(POSISI))
.Row = 24
.CellAlignment = 2
.Text = Str(BW(POSISI))
.Row = 25
.CellAlignment = 2
.Text = Str(CS)
.Row = 26
.CellAlignment = 2
.Text = Str(CD(POSISI))
.Row = 27
.CellAlignment = 2
.Text = Str(CT)
.Row = 28
.CellAlignment = 2
.Text = Str(QK1)
.Row = 29
.CellAlignment = 2
.Text = Str(E1)
.Row = 30
.Text = ""
.Row = 31
.CellAlignment = 2
.Text = Str(YC)
.Row = 32
.CellAlignment = 2
.Text = Str(YB)
.Row = 33
.CellAlignment = 2
.Text = Str(YE)
.Row = 34
.CellAlignment = 2
.Text = Str(YW1)
.Row = 35
.CellAlignment = 2
.Text = Str(QW1)
.Row = 36
.CellAlignment = 2
.Text = Str(SB1(POSISI))
.Row = 37
.CellAlignment = 2
.Text = ""
.Row = 38
.CellAlignment = 2

```



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 GADJAH MADA

```
.Text = Str(YG)
.Row = 39
.CellAlignment = 2
.Text = Str(YH(POSISI))
.Row = 40
.CellAlignment = 2
.Text = Str(YS)
.Row = 41
.CellAlignment = 2
.Text = Str(YV)
.Row = 42
.CellAlignment = 2
.Text = Str(SG1(POSISI))
.Row = 43
.CellAlignment = 3
.Text = Str(V1)
.Row = 44
.CellAlignment = 2
.Text = Str(LH1)
.Row = 45
.CellAlignment = 2
.Text = Str(W1(POSISI))

.ColWidth(2) = 1500
.Col = 2
.Row = 0
.CellAlignment = 3
.Text = "Roda Gigi II"
.Row = 1
.CellAlignment = 3
.Text = Str(N1)
.Row = 2
.CellAlignment = 2
.Text = Str(nn2)
.Row = 3
.CellAlignment = 3
.Text = Str(ii)
.Row = 4
.CellAlignment = 2
.Text = Str(ALF)
.Row = 5
.CellAlignment = 2
.Text = NB(POSISI)
.Row = 6
.CellAlignment = 2
.Text = Str(K01(POSISI))
.Row = 7
.CellAlignment = 2
.Text = Str(S0(POSISI))
.Row = 8
.CellAlignment = 2
.Text = Str(M)
.Row = 9
.CellAlignment = 2
.Text = Str(Z2)
```



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GADJAH MADA

.Row = 10
.CellAlignment = 2
.Text = Str(D02)
.Row = 11
.CellAlignment = 2
.Text = Str(A)
.Row = 12
.CellAlignment = 2
.Text = Str(DK2)
.Row = 13
.CellAlignment = 2
.Text = Str(M)
.Row = 14
.CellAlignment = 2
.Text = Str(D02)
.Row = 15
.CellAlignment = 2
.Text = Str(DF2)
.Row = 16
.CellAlignment = 2
.Text = Str(b(POSISI))
.Row = 17
.CellAlignment = 2
.Text = Str(MM)
.Row = 18
.CellAlignment = 2
.Text = Str(U)
.Row = 19
.CellAlignment = 2
.Text = Str(UU(POSISI))
.Row = 20
.CellAlignment = 2
.Text = Str(Udyn(POSISI))
.Row = 21
.CellAlignment = 2
.Text = Str(KD(POSISI))
.Row = 22
.CellAlignment = 2
.Text = Str(V)
.Row = 23
.CellAlignment = 2
.Text = Str(BB(POSISI))
.Row = 24
.CellAlignment = 2
.Text = Str(BW(POSISI))
.Row = 25
.CellAlignment = 2
.Text = Str(CS)
.Row = 26
.CellAlignment = 2
.Text = Str(CD(POSISI))
.Row = 27
.CellAlignment = 2
.Text = Str(CT)
.Row = 28



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 GADJAH MADA

```
.CellAlignment = 2
.Text = Str(QK2)
.Row = 29
.CellAlignment = 2
.Text = Str(E2)
.Row = 30
.CellAlignment = 2
.Text = ""
.Row = 31
.CellAlignment = 2
.Text = Str(YC)
.Row = 32
.CellAlignment = 2
.Text = Str(YB)
.Row = 33
.CellAlignment = 2
.Text = Str(YE)
.Row = 34
.CellAlignment = 2
.Text = Str(YW2)
.Row = 35
.CellAlignment = 2
.Text = Str(QW2)
.Row = 36
.CellAlignment = 2
.Text = Str(SB2(POSISI))
.Row = 37
.CellAlignment = 2
.Text = ""
.Row = 38
.CellAlignment = 2
.Text = Str(YG)
.Row = 39
.CellAlignment = 2
.Text = Str(YH(POSISI))
.Row = 40
.CellAlignment = 2
.Text = Str(YS)
.Row = 41
.CellAlignment = 2
.Text = Str(YV)
.Row = 42
.CellAlignment = 2
.Text = Str(SG2(POSISI))
.Row = 43
.CellAlignment = 3
.Text = Str(V1)
.Row = 44
.CellAlignment = 2
.Text = Str(LH2)
.Row = 45
.CellAlignment = 2
.Text = Str(W2(POSISI))

.ColWidth(3) = 1000
```



UNIVERSITAS
 GADJAH MADA

```
.Col = 3
.Row = 0
.CellAlignment = 3
.Text = "Satuan"
.Row = 1
.CellAlignment = 2
.Text = "Hp"
.Row = 2
.CellAlignment = 2
.Text = "Rpm"
.Row = 4
.CellAlignment = 2
.Text = "Derajad"
.Row = 6
.CellAlignment = 2
.Text = "Kg / mm2"
.Row = 7
.CellAlignment = 2
.Text = "Kg / mm2"
.Row = 8
.CellAlignment = 2
.Text = "mm"
.Row = 10
.CellAlignment = 2
.Text = "mm"
.Row = 11
.CellAlignment = 2
.Text = "mm"
.Row = 12
.CellAlignment = 2
.Text = "mm"
.Row = 13
.CellAlignment = 2
.Text = "mm"
.Row = 14
.CellAlignment = 2
.Text = "mm"
.Row = 15
.CellAlignment = 2
.Text = "mm"
.Row = 16
.CellAlignment = 2
.Text = "mm"
.Row = 17
.CellAlignment = 2
.Text = "Kgm"
.Row = 18
.CellAlignment = 2
.Text = "Kg/mm2"
.Row = 19
.CellAlignment = 2
.Text = "Kg/mm"
.Row = 20
.CellAlignment = 2
.Text = "Kg/mm2"
```

UNIVERSITAS
GADJAH MADA

.Row = 21

.CellAlignment = 2

.Text = "Kg/mm2"

.Row = 22

.CellAlignment = 2

.Text = "m/detik"

.Row = 23

.CellAlignment = 2

.Text = "Kg/mm2"

.Row = 24

.CellAlignment = 2

.Text = "Kg/mm2"

.Row = 43

.CellAlignment = 2

.Text = "Cst"

.Row = 44

.CellAlignment = 2

.Text = "Jam"

.Row = 45

.CellAlignment = 2

.Text = "kg"

End With

Screen.MousePointer = 0

End Sub



Program Pemilihan Poros dengan Menggunakan Visual Basic

INPUT DAN PROSES PERHITUNGAN POROS

Private Sub cmdOK_Click()

Dim Pt1 As Single

Dim Pr1 As Single

Dim Pt2 As Single

Dim Pr2 As Single

Dim RAr As Single

Dim RAAt As Single

Dim RBr As Single

Dim RBt As Single

Dim RA As Single

Dim RB As Single

Dim MM1 As Single

Dim MM2 As Single

Dim AMM As Single

Dim pesan As String

HP = CSng(txtIN(0).Text)

NN = CSng(txtIN(1).Text)

prsLL = CSng(txtIN(2).Text)

AA = CSng(txtIN(3).Text)

prsR1 = CSng(txtIN(7).Text)

prsB1 = CSng(txtIN(5).Text)

BG1 = CSng(txtIN(9).Text)

Select Case Pilihan

Case 0

prsBB = 0

prsB2 = 0

R2 = 0

BG2 = 0

Case 1

prsBB = CSng(txtIN(4).Text)

prsB2 = CSng(txtIN(6).Text)

R2 = CSng(txtIN(8).Text)

BG2 = CSng(txtIN(10).Text)

End Select

prsMM = 716200 * HP / NN

CC = prsLL - prsBB

DD = prsLL - AA

Pt1 = prsMM / prsR1

Pr1 = Pt1 * 0.364

P1 = (Pt1 ^ 2 + Pr1 ^ 2) ^ 0.5

If R2 = 0 Then

Pt2 = 0

Else: Pt2 = prsMM / R2

End If

Pr2 = Pt2 * 0.364

P2 = (Pt2 ^ 2 + Pr2 ^ 2) ^ 0.5



UNIVERSITAS
GADJAH MADA

```

RAr = (Pr2 * prsBB + Pr1 * DD) / prsLL
RAt = (Pt2 * prsBB + Pt1 * DD) / prsLL
RBr = (Pr1 * AA + Pr2 * CC) / prsLL
RBt = (Pt1 * AA + Pt2 * CC) / prsLL
RA = (RAr ^ 2 + RAt ^ 2) ^ 0.5
RB = (RBr ^ 2 + RBt ^ 2) ^ 0.5
MM1 = RA * AA
MM2 = RB * prsBB
If MM1 > MM2 Then
  AMM = MM1
Else
  AMM = MM2
End If
MEE = (AMM ^ 2 + (0.85 * prsMM) ^ 2) ^ 0.5
Me.Hide
prs_frmINPUTBAHAN.Show
End Sub

Private Sub cmdOK_Click()
If N > 0 Then
'perhitungan yang telah menggunakan N (banyaknya bahan)
'mumet
Dim TTK(6) As Single
Dim TT(6) As Single
Dim MJ(6) As Single
Dim TYDD(6) As Single
Dim RA1(6) As Single
Dim RA2(6) As Single
Dim RB1(6) As Single
Dim RB2(6) As Single
Dim LL1(6) As Single
Dim LL2(6) As Single
Dim DPP1(6) As Single
Dim DPP2(6) As Single
Dim G1(6) As Single
Dim G2(6) As Single
Dim DA1(6) As Single
Dim DA2(6) As Single
Dim DA3(6) As Single
Dim DA4(6) As Single
Dim DB3(6) As Single
Dim DB4(6) As Single
Dim FAA(6) As Single
Dim FAB(6) As Single
Dim FBA(6) As Single
Dim FBB(6) As Single
Dim FF1(6) As Single
Dim FF2(6) As Single
Dim Wterkecil As Single
Dim VOL(6) As Single
Dim HARGAterkecil As Single
Dim HS(6) As Single
Dim NcrSblm As Single

```



UNIVERSITAS
 GADJAH MADA

For i = 0 To N

prsNB(i) = txtNB(i).Text
 TTK(i) = CSng(txtTT(i).Text)
 MJ(i) = CSng(txtMJ(i).Text)
 HS(i) = CSng(txtHS(i).Text)

Next i

For i = 0 To N

TT(i) = 0.65 * TTK(i) / 5
 DP(i) = 2.17 * (MEE / TT(i)) ^ (1 / 3)
 Phi = 22 / 7
 VOL(i) = 0.25 * Phi * DP(i) ^ 2 * prsLL * 1.5
 HARGA(i) = VOL(i) * HS(i)

Do

prsW(i) = 1.5 / 4 * Phi * (DP(i)) ^ 2 * prsLL * (MJ(i) / 1000000)
 TYDD(i) = 5760 * prsMM / (Phi ^ 2 * 810)
 TYD(i) = TYDD(i) / DP(i) ^ 4
 If TYD(i) > 0.25 Then
 DP(i) = (TYDD(i) / 0.25) ^ 0.25
 End If
 G1(i) = P1 + BG1 + prsW(i) / 2
 If BG2 = 0 Then
 G2(i) = 0
 Else: G2(i) = P2 + BG2 + prsW(i) / 2

End If

RA1(i) = G1(i) * DD / prsLL
 RB1(i) = G1(i) - RA1(i)
 RA2(i) = G2(i) * prsBB / prsLL
 RB2(i) = G2(i) - RA2(i)
 arrRAA(i) = RA1(i) + RA2(i)
 arrRBB(i) = RB1(i) + RB2(i)
 LL1(i) = 0.3 * DP(i)
 LL2(i) = AA - 0.5 * prsB1
 DPP1(i) = 5 + DP(i)
 DPP2(i) = 10 + DP(i)
 DA1(i) = LL1(i) ^ 3 / DPP1(i) ^ 4
 DA2(i) = (LL2(i) ^ 3 - LL1(i) ^ 3) / DPP1(i) ^ 4
 DA3(i) = (AA ^ 3 - LL2(i) ^ 3) / DPP2(i) ^ 4
 DA4(i) = ((prsLL - prsBB) ^ 3 - LL2(i) ^ 3) / DPP2(i) ^ 4
 DB3(i) = (DD ^ 3 - LL2(i) ^ 3) / DPP2(i) ^ 4
 DB4(i) = (CC ^ 3 - LL2(i) ^ 3) / DPP2(i) ^ 4
 FAA(i) = RA1(i) * 6.8 * (DA1(i) + DA2(i) + DA3(i)) / 210000
 FAB(i) = RB1(i) * 6.8 * (DA1(i) + DA2(i) + DB3(i)) / 210000
 FBA(i) = RA2(i) * 6.8 * (DA1(i) + DA2(i) + DA4(i)) / 210000
 FBB(i) = RB2(i) * 6.8 * (DA1(i) + DA2(i) + DA4(i)) / 210000
 FF1(i) = FAA(i) + (FAB(i) - FAA(i)) * AA / prsLL
 FF2(i) = FBA(i) + (FBB(i) - FBA(i)) * prsBB / prsLL
 If FF1(i) > FF2(i) Then
 FF(i) = FF1(i)
 Else
 FF(i) = FF2(i)

End If

NcrSblm = Ncr(i)

Ncr(i) = 300 * (1 / FF(i)) ^ 0.5



UNIVERSITAS

```

If Ncr(i) < NcrSblm Then MsgBox "NCR JADI KECIL"
If NN > Ncr(i) Then DP(i) = DP(i) + 1
DoEvents
Loop While NN > Ncr(i)
Next i

```

```

HARGAterkecil = HARGA(0)
For i = 1 To N
  If HARGAterkecil > HARGA(i) Then
    HARGAterkecil = HARGA(i)
    POSISI = i
  End If
Next i

```

```

Me.Hide
End Sub

```

OUTPUT HASIL PERHITUNGAN POROS

```
Private Sub Form_Activate()
```

```

With GR
DoEvents
.ColWidth(0) = 3500
.ColWidth(1) = 1500
.ColWidth(2) = 1000

.Col = 0
.Row = 1
.Text = "Daya Yang Ditransmisikan"
.Row = 2
.Text = "Putaran Poros "
.Row = 3
.Text = "Panjang Poros"
.Row = 4
.Text = "Jarak Roda Gigi I Dengan A"
.Row = 5
.Text = "Jarak Roda Gigi II Dengan B"
.Row = 6
.Text = "Lebar Roda Gigi I"
.Row = 7
.Text = "Lebar Roda Gigi II"
.Row = 8
.Text = "Jari-Jari Roda Gigi I"
.Row = 9
.Text = "Jari-Jari Roda Gigi II"
.Row = 10
.Text = "Berat Roda Gigi I"
.Row = 11
.Text = "Berat Roda Gigi II"
.Row = 12
.Text = "Bahan Poros"
.Row = 13
.Text = "Diameter Minimal Poros"
.Row = 14
.Text = "Berat Poros"
.Row = 15

```



UNIVERSITAS
 GADJAH MADA

.Text = "Puntiran Maksimal"
 .Row = 16
 .Text = "Simpangan Maksimal"
 .Row = 17
 .Text = "Putaran Kritis"
 .Row = 18
 .Text = "Reaksi di A"
 .Row = 19
 .Text = "Reaksi di B"
 .Row = 20
 .Text = "BANTALAN DI A"
 .Row = 21
 .Text = " Jenis Bantalan"
 .Row = 22
 .Text = " Kapasitas Beban (C)"
 .Row = 23
 .Text = " Diameter Dalam (d)"
 .Row = 24
 .Text = " Diameter Luar (D)"
 .Row = 25
 .Text = " Fillet (r)"
 .Row = 26
 .Text = " Lebar (b)"
 .Row = 27
 .Text = "BANTALAN DI B"
 .Row = 28
 .Text = " Jenis Bantalan"
 .Row = 29
 .Text = " Kapasitas Beban (C)"
 .Row = 30
 .Text = " Diameter Dalam (d)"
 .Row = 31
 .Text = " Diameter Luar (D)"
 .Row = 32
 .Text = " Fillet (r)"
 .Row = 33
 .Text = " Lebar (b)"
 .Row = 34
 .Text = "Umur Bantalan di A"
 .Row = 35
 .Text = "Umur Bantalan di B"

.Col = 1
 .Row = 0
 .CellAlignment = 3
 .Text = "Ukuran"
 .Row = 1
 .CellAlignment = 2
 .Text = Str(HP)
 .Row = 2
 .CellAlignment = 2
 .Text = Str(NN)
 .Row = 3
 .CellAlignment = 2



UNIVERSITAS
GADJAH MADA

```
.Text = prsLL
.Row = 4
.CellAlignment = 2
.Text = Str(AA)
.Row = 5
.CellAlignment = 2
.Text = Str(prsBB)
.Row = 6
.CellAlignment = 2
.Text = Str(prsB1)
.Row = 7
.CellAlignment = 2
.Text = Str(prsB2)
.Row = 8
.CellAlignment = 2
.Text = Str(prsR1)
.Row = 9
.CellAlignment = 2
.Text = Str(R2)
.Row = 10
.CellAlignment = 2
.Text = Str(BG1)
.Row = 11
.CellAlignment = 2
.Text = Str(BG2)
.Row = 12
.CellAlignment = 2
.Text = prsNB(POSISI)
.Row = 13
.CellAlignment = 2
.Text = Str(DP(POSISI))
.Row = 14
.CellAlignment = 2
.Text = Str(prsW(POSISI))
.Row = 15
.CellAlignment = 2
.Text = Str(TYD(POSISI))
.Row = 16
.CellAlignment = 2
.Text = Str(FF(POSISI))
.Row = 17
.CellAlignment = 2
.Text = Str(Ncr(POSISI))
.Row = 18
.CellAlignment = 2
.Text = Str(arrRAA(POSISI))
.Row = 19
.CellAlignment = 2
.Text = Str(arrRBB(POSISI))
.Row = 21
.CellAlignment = 2
.Text = XX
.Row = 22
.CellAlignment = 2
.Text = C01
```



UNIVERSITAS
GADJAH MADA

```

.Row = 28
.CellAlignment = 2
.Text = XX2
.Row = 29
.CellAlignment = 2
.Text = C02
.Row = 34
.CellAlignment = 2
.Text = Str(UAH)
.Row = 35
.CellAlignment = 2
.Text = Str(UBH)

.Col = 2
.Row = 0
.CellAlignment = 3
.Text = "Satuan"
.Row = 1
.CellAlignment = 2
.Text = "Hp"
.Row = 2
.Text = "Rpm"
.Row = 3
.Text = "mm"
.Row = 4
.Text = "mm"
.Row = 5
.Text = "mm"
.Row = 6
.Text = "mm"
.Row = 7
.Text = "mm"
.Row = 8
.Text = "mm"
.Row = 9
.Text = "mm"
.Row = 10
.Text = "Kg"
.Row = 11
.Text = "Kg"
.Row = 13
.Text = "mm"
.Row = 14
.Text = "Kg"
.Row = 15
.Text = "Kgm"
.Row = 16
.Text = "mm"
.Row = 17
.Text = "Rpm"
.Row = 18
.Text = "Kg"
.Row = 19
.Text = "Kg"
.Row = 22

```



UNIVERSITAS
GADJAH MADA

.Text = "Kg"

.Row = 29

.Text = "Kg"

.Row = 34

.Text = "Jam"

.Row = 35

.Text = "Jam"

End With

End Sub



Analisis Struktur Rangka Konveyor I dengan Menggunakan SAP90

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PAGE 1

PROGRAM:SAP90/FILE:PRANG1.SAP

STRUKTUR FRAME BAGIAN ATAS KONVEYOR I

S Y S T E M D A T A

```

EXECUTION CODE - - - - - 0
NUMBER OF LOAD CONDITIONS - - - - - 2
STEADY STATE LOAD FREQUENCY - - - - - -0.0000E+00
NUMBER OF EIGENVALUES - - - - - 0
EIGEN CONVERGENCE TOLERANCE - - - - - -0.1000E-03
EIGEN CUTOFF TIME PERIOD - - - - - -0.0000E+00
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```

PAGE 2

PROGRAM:SAP90/FILE:PRANG1.SAP

STRUKTUR FRAME BAGIAN ATAS KONVEYOR I

G E N E R A T E D J O I N T C O O R D I N A T E S

JOINT	X	Y	Z
1	0.000	0.000	0.000
2	250.000	0.000	0.000
3	500.000	0.000	0.000
4	720.000	0.000	0.000
5	840.000	0.000	0.000
6	0.000	0.000	65.500
7	250.000	0.000	65.500
8	500.000	0.000	65.500
9	720.000	0.000	65.500
10	0.000	0.000	116.400
11	250.000	0.000	116.400
12	500.000	0.000	116.400
13	720.000	0.000	116.400
14	0.000	0.000	133.500
15	250.000	0.000	133.500
16	500.000	0.000	133.500
17	720.000	0.000	133.500
18	0.000	195.000	0.000
19	250.000	195.000	0.000
20	500.000	195.000	0.000
21	720.000	195.000	0.000
22	840.000	195.000	0.000
23	0.000	195.000	65.500
24	250.000	195.000	65.500
25	500.000	195.000	65.500
26	720.000	195.000	65.500
27	0.000	195.000	116.400
28	250.000	195.000	116.400



UNIVERSITAS
 GADJAH MADA

29	500.000	195.000	116.400
30	720.000	195.000	116.400
31	0.000	195.000	133.500
32	250.000	195.000	133.500
33	500.000	195.000	133.500
34	720.000	195.000	133.500
35	0.000	-132.500	0.000
36	250.000	-132.500	0.000
37	500.000	-132.500	0.000
38	720.000	-132.500	0.000
39	840.000	-132.500	0.000
40	0.000	327.500	0.000
41	250.000	327.500	0.000
42	500.000	327.500	0.000
43	720.000	327.500	0.000
44	840.000	327.500	0.000

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PAGE 3

PROGRAM:SAP90/FILE:PRANG1.SAP

STRUKTUR FRAME BAGIAN ATAS KONVEYOR I

R E S T R A I N T D A T A

JOINT	RX	RY	RZ	RXX	RYY	RZZ
1	1	1	1	1	1	1
5	1	1	1	1	1	1
18	1	1	1	1	1	1
22	1	1	1	1	1	1
35	1	1	1	1	1	1
39	1	1	1	1	1	1
40	1	1	1	1	1	1
44	1	1	1	1	1	1

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PROGRAM:SAP90/FILE:PRANG1.SAP

STRUKTUR FRAME BAGIAN ATAS KONVEYOR I

F R A M E C O N T R O L D A T A

NUMBER OF MEMBER SECTION PROPERTIES	6
NUMBER OF SPAN LOADING PATTERNS	2
NUMBER OF MEMBER FORCE OUTPUT STATIONS	5

LOAD COND	GRAVITATIONAL MULTIPLIERS			TEMPERATURE	PRESTRESS
	X	Y	Z	MULTIPLIERS	MULTIPLIERS
1	0.000	0.000	-1.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000



STRUKTUR FRAME BAGIAN ATAS KONVEYOR I

SECTION PROPERTY DATA

PROP ID	AREA	TORSIONAL INERTIA	MOMENTS OF INERTIA		SHEAR AREAS	
			I33	I22	A2	A3
1	0.111E+03	0.00000E+00	0.11690E+05	0.00000E+00	0.111E+03	0.111E+03
2	0.240E+02	0.00000E+00	0.92500E+03	0.85300E+02	0.240E+02	0.240E+02
3	0.554E+02	0.00000E+00	0.16800E+04	0.16800E+04	0.554E+02	0.554E+02
4	0.116E+02	0.00000E+00	0.14000E+03	0.14000E+03	0.116E+02	0.116E+02
5	0.558E+02	0.00000E+00	0.32860E+03	0.64612E+03	0.558E+02	0.558E+02
6	0.154E+03	0.00000E+00	0.25760E+05	0.90100E+04	0.154E+03	0.154E+03

STRUKTUR FRAME BAGIAN ATAS KONVEYOR I

MATERIAL PROPERTY DATA

PROP ID	MODULUS OF ELASTICITY	SHEAR MODULUS	WEIGHT PER UNIT LEN	MASS PER UNIT LEN	THERMAL EXPANSION
2	0.2039E+07	0.7842E+06	0.1844E+01	0.1880E+00	0.0000E+00
3	0.2039E+07	0.7842E+06	0.4267E+01	0.4350E+00	0.0000E+00
4	0.2039E+07	0.7842E+06	0.8920E+00	0.9090E-01	0.0000E+00
5	0.2039E+07	0.7842E+06	0.4297E+01	0.4380E+00	0.0000E+00
6	0.2039E+07	0.7842E+06	0.1187E+02	0.1210E+01	0.0000E+00

STRUKTUR FRAME BAGIAN ATAS KONVEYOR I

SPAN LOADING DATA

UNIFORM LOAD DATA

PATTERN ID	1-DIR	2-DIR	3-DIR	X-DIR	Y-DIR	Z-DIR
2	0.0000	0.0000	0.0000	0.0000	0.0000	-1.3800

STRUKTUR FRAME BAGIAN ATAS KONVEYOR I

FRAME ELEMENT DATA

ELT ID	JOINT END-I	JOINT END-J	LOCAL-AXIS		PROPERTY-ID		REL VAR	REL CODES	REF ELEMENT	
			N1	N2	END-I	END-J			TEMP	LENGTH
1	1	2	2	0	1	1	0	000000	0.00	250.00
2	2	3	2	0	1	1	0	000000	0.00	250.00
3	3	4	2	0	1	1	0	000000	0.00	220.00
4	4	5	2	0	1	1	0	000000	0.00	120.00
5	6	7	2	0	5	5	0	000000	0.00	250.00
6	7	8	2	0	5	5	0	000000	0.00	250.00
7	8	9	2	0	5	5	0	000000	0.00	220.00



UNIVERSITAS
 GADJAH MADA

8	14	15	2	0	5	5	0	000000	0.00	250.00
9	15	16	2	0	5	5	0	000000	0.00	250.00
10	16	17	2	0	5	5	0	000000	0.00	220.00
11	18	19	2	0	1	1	0	000000	0.00	250.00
12	19	20	2	0	1	1	0	000000	0.00	250.00
13	20	21	2	0	1	1	0	000000	0.00	220.00
14	21	22	2	0	1	1	0	000000	0.00	120.00
15	23	24	2	0	5	5	0	000000	0.00	250.00
16	24	25	2	0	5	5	0	000000	0.00	250.00
17	25	26	2	0	5	5	0	000000	0.00	220.00
18	31	32	2	0	5	5	0	000000	0.00	250.00
19	32	33	2	0	5	5	0	000000	0.00	250.00
20	33	34	2	0	5	5	0	000000	0.00	220.00
21	1	6	2	0	2	2	0	000000	0.00	65.50
22	2	7	2	0	2	2	0	000000	0.00	65.50
23	3	8	2	0	2	2	0	000000	0.00	65.50
24	4	9	2	0	2	2	0	000000	0.00	65.50
25	6	10	2	0	2	2	0	000000	0.00	50.90
26	7	11	2	0	2	2	0	000000	0.00	50.90
27	8	12	2	0	2	2	0	000000	0.00	50.90
28	9	13	2	0	2	2	0	000000	0.00	50.90
29	10	14	2	0	2	2	0	000000	0.00	17.10
30	11	15	2	0	2	2	0	000000	0.00	17.10
31	12	16	2	0	2	2	0	000000	0.00	17.10
32	13	17	2	0	2	2	0	000000	0.00	17.10
33	18	23	2	0	2	2	0	000000	0.00	65.50
34	19	24	2	0	2	2	0	000000	0.00	65.50
35	20	25	2	0	2	2	0	000000	0.00	65.50
36	21	26	2	0	2	2	0	000000	0.00	65.50
37	23	27	2	0	2	2	0	000000	0.00	50.90
38	24	28	2	0	2	2	0	000000	0.00	50.90
39	25	29	2	0	2	2	0	000000	0.00	50.90
40	26	30	2	0	2	2	0	000000	0.00	50.90
41	27	31	2	0	2	2	0	000000	0.00	17.10
42	28	32	2	0	2	2	0	000000	0.00	17.10
43	29	33	2	0	2	2	0	000000	0.00	17.10
44	30	34	2	0	2	2	0	000000	0.00	17.10
45	1	18	1	0	3	3	0	000000	0.00	195.00
46	2	19	1	0	3	3	0	000000	0.00	195.00
47	3	20	1	0	3	3	0	000000	0.00	195.00
48	4	21	1	0	3	3	0	000000	0.00	195.00
49	10	27	1	0	4	4	0	000000	0.00	195.00
50	11	28	1	0	4	4	0	000000	0.00	195.00
51	12	29	1	0	4	4	0	000000	0.00	195.00

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STRUKTUR FRAME BAGIAN ATAS KONVEYOR I

FRAME ELEMENT DATA

ELT ID	JOINT END-I	JOINT END-J	LOCAL-AXIS		PROPERTY-ID		REL VAR	REL CODES	REF TEMP	ELEMENT LENGTH
			N1	N2	END-I	END-J				
52	13	30	1	0	4	4	0	000000	0.00	195.00
59	1	35	1	0	3	3	0	000000	0.00	132.50
60	2	36	1	0	3	3	0	000000	0.00	132.50



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61	3	37	1	0	3	3	0	000000	0.00	132.50
62	4	38	1	0	3	3	0	000000	0.00	132.50
63	18	40	1	0	3	3	0	000000	0.00	132.50
64	19	41	1	0	3	3	0	000000	0.00	132.50
65	20	42	1	0	3	3	0	000000	0.00	132.50
66	21	43	1	0	3	3	0	000000	0.00	132.50
67	35	36	2	0	6	6	0	000000	0.00	250.00
68	36	37	2	0	6	6	0	000000	0.00	250.00
69	37	38	2	0	6	6	0	000000	0.00	220.00
70	38	39	2	0	6	6	0	000000	0.00	120.00
71	40	41	2	0	6	6	0	000000	0.00	250.00
72	41	42	2	0	6	6	0	000000	0.00	250.00
73	42	43	2	0	6	6	0	000000	0.00	220.00
74	43	44	2	0	6	6	0	000000	0.00	120.00
75	2	35	1	35	3	3	0	000000	0.00	282.94
76	2	37	1	35	3	3	0	000000	0.00	282.94
77	4	37	1	35	3	3	0	000000	0.00	256.82
78	19	40	1	35	3	3	0	000000	0.00	282.94
79	19	42	1	35	3	3	0	000000	0.00	282.94
80	21	42	1	35	3	3	0	000000	0.00	256.82
81	2	10	1	2	2	2	0	000000	0.00	275.77
82	3	11	1	2	2	2	0	000000	0.00	275.77
83	4	12	1	2	2	2	0	000000	0.00	248.90
84	19	27	18	19	2	2	0	000000	0.00	275.77
85	20	28	18	19	2	2	0	000000	0.00	275.77
86	21	29	18	19	2	2	0	000000	0.00	248.90
90	4	39	1	0	3	3	0	000000	0.00	178.76
91	21	44	1	0	3	3	0	000000	0.00	178.76

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PROGRAM:SAP90/FILE:PRANG1.SAP

STRUKTUR FRAME BAGIAN ATAS KONVEYOR I

B E A M S P A N L O A D I N G P A T T E R N S

ELT ID	LOAD 1	LOAD 2
5	2	0
6	2	0
7	2	0
8	1	0
9	1	0
10	1	0
15	2	0
16	2	0
17	2	0
18	1	0
19	1	0
20	1	0

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STRUKTUR FRAME BAGIAN ATAS KONVEYOR I

T O T A L W E I G H T S A N D M A S S E S

PROP	WEIGHT	MASS
------	--------	------



UNIVERSITAS

1	14404.3200	1468.3200
2	4921.3963	501.7476
3	16397.7982	1671.6762
4	695.7600	70.9020
5	12375.3600	1261.4400
6	19941.6000	2032.8000

TOTAL 68736.2345 7006.8857

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PROGRAM:SAP90/FILE:PRANG1.SAP

STRUKTUR FRAME BAGIAN ATAS KONVEYOR I

POINT LOADS

POINT	LOAD	FX	FY	FZ	MX	MY	MZ
6	2	-0.290E+03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
7	2	-0.290E+03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
23	2	-0.290E+03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
24	2	-0.290E+03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
8	2	-0.255E+03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
25	2	-0.255E+03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
14	2	-0.663E+03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
15	2	-0.663E+03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
31	2	-0.663E+03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
32	2	-0.663E+03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
16	2	-0.583E+03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
33	2	-0.583E+03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

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STRUKTUR FRAME BAGIAN ATAS KONVEYOR I

LOAD CONDITION COMBINATION MULTIPLIERS

COMBINATION	CONDITION	FACTOR
1	1	1.000
	2	1.000

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STRUKTUR FRAME BAGIAN ATAS KONVEYOR I

OUTPUT FILES CREATED BY PROGRAM

INPUT DATA ECHO	PRANG1.SAP
SOLUTION ERRORS AND WARNINGS	PRANG1.ERR
EQUATION NUMBERING	PRANG1.EQN
DISPLACEMENTS AND REACTIONS	PRANG1.SOL
FRAME ELEMENT FORCES	PRANG1.F3F



STRUKTUR FRAME BAGIAN ATAS KONVEYOR I

FRAME ELEMENT FORCES

ELT ID	LOAD COMB	DIST ENDI	1-2 PLANE		AXIAL FORCE	1-3 PLANE		AXIAL TORQ
			SHEAR	MOMENT		SHEAR	MOMENT	
1 -----								
1	1	0.000			-5995.793			
		0.000	-4054.552	523350.117		0.000	0.000	
		62.500	-3518.677	286686.732		0.000	0.000	
		125.000	-2982.802	83515.534		0.000	0.000	
		187.500	-2446.927	-86163.476		0.000	0.000	
		250.000	-1911.052	-222350.299		0.000	0.000	
		250.000			-5995.793			
2 -----								
2	1	0.000			4200.496			
		0.000	-750.788	-132082.452		0.000	0.000	
		62.500	-214.913	-162260.634		0.000	0.000	
		125.000	320.962	-158946.629		0.000	0.000	
		187.500	856.837	-122140.436		0.000	0.000	
		250.000	1392.712	-51842.055		0.000	0.000	
		250.000			4200.496			
3 -----								
3	1	0.000			5518.314			
		0.000	-1334.134	-73677.013		0.000	0.000	
		55.000	-862.564	-134086.235		0.000	0.000	
		110.000	-390.994	-168559.107		0.000	0.000	
		165.000	80.576	-177095.630		0.000	0.000	
		220.000	552.146	-159695.802		0.000	0.000	
		220.000			5518.314			
4 -----								
4	1	0.000			-6376.704			
		0.000	10005.215	-279451.170		0.000	0.000	
		30.000	10262.435	24563.568		0.000	0.000	
		60.000	10519.655	336294.907		0.000	0.000	
		90.000	10776.875	655742.846		0.000	0.000	
		120.000	11034.095	982907.384		0.000	0.000	
		120.000			-6376.704			
5 -----								
5	1	0.000			-3208.640			
		0.000	-805.161	39517.565		-0.575	0.000	
		62.500	-450.349	282.879		-0.575	-35.939	
		125.000	-95.536	-16776.026		-0.575	-71.879	
		187.500	259.276	-11659.150		-0.575	-107.818	
		250.000	614.089	15633.507		-0.575	-143.758	
		250.000			-3208.640			
6 -----								
6	1	0.000			-5406.586			
		0.000	-768.026	35352.683		1.274	-143.758	
		62.500	-413.213	-1561.034		1.274	-64.107	
		125.000	-58.401	-16298.970		1.274	15.544	



FRAME ELEMENT FORCES

ELT ID	LOAD COMB	DIST ENDI	1-2 PLANE		AXIAL FORCE	1-3 PLANE		AXIAL TORQ
			SHEAR	MOMENT		SHEAR	MOMENT	
		187.500	296.412	-8861.124		1.274	95.195	
		250.000	651.224	20752.503		1.274	174.846	
		250.000			-5406.586			
7	1	0.000			-1330.901			
		0.000	-500.651	11013.510		-0.795	174.846	
		55.000	-188.416	-7935.807		-0.795	131.134	
		110.000	123.819	-9712.199		-0.795	87.423	
		165.000	436.054	5684.334		-0.795	43.711	
		220.000	748.289	38253.792		-0.795	0.000	
		220.000			-1330.901			
8	1	0.000			-8853.996			
		0.000	-1086.592	59371.965		0.122	0.000	
		62.500	-620.529	6024.429		0.122	7.626	
		125.000	-154.467	-18194.201		0.122	15.253	
		187.500	311.596	-13283.926		0.122	22.879	
		250.000	777.658	20755.257		0.122	30.506	
		250.000			-8853.996			
9	1	0.000			-10104.708			
		0.000	-888.717	35316.372		-0.244	30.506	
		62.500	-422.654	-5663.987		-0.244	15.261	
		125.000	43.408	-17515.440		-0.244	0.016	
		187.500	509.471	-237.986		-0.244	-15.229	
		250.000	975.533	46168.374		-0.244	-30.474	
		250.000			-10104.708			
10	1	0.000			-935.824			
		0.000	-629.353	4888.953		0.139	-30.474	
		55.000	-219.218	-18446.773		0.139	-22.856	
		110.000	190.917	-19225.075		0.139	-15.237	
		165.000	601.052	2554.048		0.139	-7.619	
		220.000	1011.187	46890.596		0.139	0.000	
		220.000			-935.824			
11	1	0.000			-5995.793			
		0.000	-4054.552	523350.117		0.000	0.000	
		62.500	-3518.677	286686.732		0.000	0.000	
		125.000	-2982.802	83515.534		0.000	0.000	
		187.500	-2446.927	-86163.476		0.000	0.000	
		250.000	-1911.052	-222350.299		0.000	0.000	
		250.000			-5995.793			
12	1	0.000			4200.496			



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ELT LOAD ID COMB	DIST ENDI	1-2 PLANE		AXIAL FORCE	1-3 PLANE		AXIAL TORQ
		SHEAR	MOMENT		SHEAR	MOMENT	
	0.000	-750.788	-132082.452		0.000	0.000	
	62.500	-214.913	-162260.634		0.000	0.000	
	125.000	320.962	-158946.629		0.000	0.000	
	187.500	856.837	-122140.436		0.000	0.000	
	250.000	1392.712	-51842.055		0.000	0.000	
	250.000			4200.496			
13							
1	0.000			5518.314			
	0.000	-1334.134	-73677.013		0.000	0.000	
	55.000	-862.564	-134086.235		0.000	0.000	
	110.000	-390.994	-168559.107		0.000	0.000	
	165.000	80.576	-177095.630		0.000	0.000	
	220.000	552.146	-159695.802		0.000	0.000	
	220.000			5518.314			
14							
1	0.000			-6376.704			
	0.000	10005.215	-279451.170		0.000	0.000	
	30.000	10262.435	24563.568		0.000	0.000	
	60.000	10519.655	336294.907		0.000	0.000	
	90.000	10776.875	655742.846		0.000	0.000	
	120.000	11034.095	982907.384		0.000	0.000	
	120.000			-6376.704			
15							
1	0.000			-3208.640			
	0.000	-805.161	39517.565		0.575	0.000	
	62.500	-450.349	282.879		0.575	35.939	
	125.000	-95.536	-16776.026		0.575	71.879	
	187.500	259.276	-11659.150		0.575	107.818	
	250.000	614.089	15633.507		0.575	143.758	
	250.000			-3208.640			
16							
1	0.000			-5406.586			
	0.000	-768.026	35352.683		-1.274	143.758	
	62.500	-413.213	-1561.034		-1.274	64.107	
	125.000	-58.401	-16298.970		-1.274	-15.544	
	187.500	296.412	-8861.124		-1.274	-95.195	
	250.000	651.224	20752.503		-1.274	-174.846	
	250.000			-5406.586			
17							
1	0.000			-1330.901			
	0.000	-500.651	11013.510		0.795	-174.846	
	55.000	-188.416	-7935.807		0.795	-131.134	
	110.000	123.819	-9712.199		0.795	-87.423	
	165.000	436.054	5684.334		0.795	-43.711	
	220.000	748.289	38253.792		0.795	0.000	
	220.000			-1330.901			

STRUKTUR FRAME BAGIAN ATAS KONVEYOR I

FRAME ELEMENT FORCES

ELT LOAD ID COMB	DIST ENDI	1-2 PLANE		AXIAL FORCE	1-3 PLANE		AXIAL TORQ
		SHEAR	MOMENT		SHEAR	MOMENT	



Perancangan Deep Drawn Pan Conveyor (Clinker Transport Kapasitas 500 Ton / Jam)

Pamuji, Ir. Gregorius Harjanto

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18	1	0.000			-8853.996		
		0.000	-1086.592	59371.965	-0.122	0.000	
		62.500	-620.529	6024.429	-0.122	-7.626	
		125.000	-154.467	-18194.201	-0.122	-15.253	
		187.500	311.596	-13283.926	-0.122	-22.879	
		250.000	777.658	20755.257	-0.122	-30.506	
		250.000				-8853.996	
19	1	0.000			-10104.708		
		0.000	-888.717	35316.372	0.244	-30.506	
		62.500	-422.654	-5663.987	0.244	-15.261	
		125.000	43.408	-17515.440	0.244	-0.016	
		187.500	509.471	-237.986	0.244	15.229	
		250.000	975.533	46168.374	0.244	30.474	
		250.000				-10104.708	
20	1	0.000			-935.824		
		0.000	-629.353	4888.953	-0.139	30.474	
		55.000	-219.218	-18446.773	-0.139	22.856	
		110.000	190.917	-19225.075	-0.139	15.237	
		165.000	601.052	2554.048	-0.139	7.619	
		220.000	1011.187	46890.596	-0.139	0.000	
		220.000				-935.824	
21	1	0.000			-7981.165		
		0.000	1230.768	-15812.658	22.286	-860.003	
		16.375	1230.768	4341.174	22.286	-495.075	
		32.750	1230.768	24495.007	22.286	-130.146	
		49.125	1230.768	44648.839	22.286	234.783	
		65.500	1230.768	64802.672	22.286	599.712	
		65.500				-7860.382	
22	1	0.000			-4756.514		
		0.000	2013.348	-94812.548	33.136	-1809.229	
		16.375	2013.348	-61843.980	33.136	-1266.623	
		32.750	2013.348	-28875.412	33.136	-724.017	
		49.125	2013.348	4093.156	33.136	-181.411	
		65.500	2013.348	37061.723	33.136	361.196	
		65.500				-4635.732	
23	1	0.000			2690.837		
		0.000	-1064.266	30961.229	26.781	-1400.268	
		16.375	-1064.266	13533.876	26.781	-961.732	
		32.750	-1064.266	-3893.478	26.781	-523.195	

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Computer and Structures, Inc.,

STRUKTUR FRAME BAGIAN ATAS KONVEYOR I

FRAME ELEMENT FORCES

ELT LOAD ID COMB	DIST ENDI	1-2 PLANE		AXIAL FORCE	1-3 PLANE		AXIAL TORQ
		SHEAR	MOMENT		SHEAR	MOMENT	
	49.125	-1064.266	-21320.831	26.781	-84.659		
	65.500	-1064.266	-38748.184	26.781	353.878		
	65.500			2811.619			



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24	-----					
1	0.000					-2092.620
	0.000	-2266.726	126962.187	44.035		-2824.360
	16.375	-2266.726	89844.554	44.035		-2103.290
	32.750	-2266.726	52726.921	44.035		-1382.220
	49.125	-2266.726	15609.288	44.035		-661.150
	65.500	-2266.726	-21508.346	44.035		59.920
	65.500					-1971.838
25	-----					
1	0.000					-7055.221
	0.000	-2267.872	25285.107	22.861		599.712
	12.725	-2267.872	-3573.560	22.861		890.615
	25.450	-2267.872	-32432.227	22.861		1181.519
	38.175	-2267.872	-61290.893	22.861		1472.422
	50.900	-2267.872	-90149.560	22.861		1763.325
	50.900					-6961.362
26	-----					
1	0.000					-3253.617
	0.000	-474.598	17342.548	31.287		361.196
	12.725	-474.598	11303.284	31.287		759.320
	25.450	-474.598	5264.020	31.287		1157.445
	38.175	-474.598	-775.243	31.287		1555.570
	50.900	-474.598	-6814.507	31.287		1953.694
	50.900					-3159.758
27	-----					
1	0.000					3963.494
	0.000	2756.219	-29009.190	28.850		353.878
	12.725	2756.219	6063.692	28.850		720.994
	25.450	2756.219	41136.575	28.850		1088.111
	38.175	2756.219	76209.457	28.850		1455.227
	50.900	2756.219	111282.340	28.850		1822.344
	50.900					4057.354
28	-----					
1	0.000					-1223.549
	0.000	-935.824	16745.447	43.240		59.920
	12.725	-935.824	4837.084	43.240		610.150
	25.450	-935.824	-7071.278	43.240		1160.379
	38.175	-935.824	-18979.641	43.240		1710.609
	50.900	-935.824	-30888.003	43.240		2260.838
	50.900					-1129.689
29	-----					
1	0.000					-1118.124

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 PROGRAM:SAP90/FILE:PRANG1.F3F

STRUKTUR FRAME BAGIAN ATAS KONVEYOR I

FRAME ELEMENT FORCES

ELT LOAD ID COMB	DIST ENDI	1-2 PLANE		AXIAL FORCE	1-3 PLANE		AXIAL TORQ
		SHEAR	MOMENT		SHEAR	MOMENT	
	0.000	9516.496	-103360.123		0.122	-2.087	
	4.275	9516.496	-62677.101		0.122	-1.565	
	8.550	9516.496	-21994.079		0.122	-1.043	
	12.825	9516.496	18688.943		0.122	-0.522	
	17.100	9516.496	59371.965		0.122	0.000	
	17.100						-1086.592



Perancangan Deep Drawn Pan Conveyor (Clinker Transport Kapasitas 500 Ton / Jam)

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48	-----					
1	0.000			-421.381		
	0.000	0.000	309.812	416.032	-346.967	
	48.750	0.000	309.812	208.016	14864.221	
	97.500	0.000	309.812	0.000	19934.617	
	146.250	0.000	309.812	-208.016	14864.221	
	195.000	0.000	309.812	-416.033	-346.967	
	195.000			-421.381		
49	-----					
1	0.000			-28.065		
	0.000	0.000	-412.921	86.970	-1957.668	
	48.750	0.000	-412.921	43.485	1222.173	
	97.500	0.000	-412.921	0.000	2282.120	
	146.250	0.000	-412.921	-43.485	1222.173	
	195.000	0.000	-412.921	-86.970	-1957.668	
	195.000			-28.065		
50	-----					
1	0.000			-36.258		
	0.000	0.000	-351.510	86.970	-2111.099	
	48.750	0.000	-351.510	43.485	1068.741	
	97.500	0.000	-351.510	0.000	2128.688	
	146.250	0.000	-351.510	-43.485	1068.741	
	195.000	0.000	-351.510	-86.970	-2111.099	
	195.000			-36.258		
51	-----					
1	0.000			-49.182		
	0.000	0.000	-590.585	86.970	-2141.356	
	48.750	0.000	-590.585	43.485	1038.484	
	97.500	0.000	-590.585	0.000	2098.431	
	146.250	0.000	-590.585	-43.485	1038.484	
	195.000	0.000	-590.585	-86.970	-2141.356	
	195.000			-49.182		

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STRUKTUR FRAME BAGIAN ATAS KONVEYOR I

FRAME ELEMENT FORCES

ELT ID	LOAD COMB	DIST ENDI	1-2 PLANE		AXIAL FORCE	1-3 PLANE		AXIAL TORQ
			SHEAR	MOMENT		SHEAR	MOMENT	
52	-----							
1	0.000				-43.379			
	0.000	0.000	0.000	0.000	86.970	-2258.470		
	48.750	0.000	0.000	0.000	43.485	921.371		
	97.500	0.000	0.000	0.000	0.000	1981.318		
	146.250	0.000	0.000	0.000	-43.485	921.371		
	195.000	0.000	0.000	0.000	-86.970	-2258.470		
	195.000				-43.379			
59	-----							
1	0.000				0.000			
	0.000	0.000	0.000	0.000	282.689	-6242.710		
	33.125	0.000	0.000	0.000	141.344	780.339		
	66.250	0.000	0.000	0.000	0.000	3121.355		
	99.375	0.000	0.000	0.000	-141.344	780.339		
	132.500	0.000	0.000	0.000	-282.689	-6242.710		
	132.500				0.000			



Perancangan Deep Drawn Pan Conveyor (Clinker Transport Kapasitas 500 Ton / Jam)

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78 -----						
1	0.000				-2294.680	
	0.000	-317.234	832.261		-4.462	1126.427
	70.736	-15.406	-10932.482		-4.462	810.784
	141.471	286.423	-1347.223		-4.462	495.141
	212.207	588.251	29588.037		-4.462	179.499
	282.942	890.080	81873.298		-4.462	-136.144
	282.942				-2294.680	

79 -----						
1	0.000				1732.871	
	0.000	659.351	-16624.698		1.205	-679.562
	70.736	357.523	19339.862		1.205	-594.307
	141.471	55.694	33954.421		1.205	-509.053
	212.207	-246.134	27218.978		1.205	-423.798
	282.942	-547.963	-866.465		1.205	-338.544
	282.942				1732.871	

80 -----						
1	0.000				951.204	
	0.000	-492.559	3697.522		-6.201	693.921
	64.205	-218.597	-19132.336		-6.201	295.815
	128.410	55.365	-24372.487		-6.201	-102.292

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STRUKTUR FRAME BAGIAN ATAS KONVEYOR I

FRAME ELEMENT FORCES

ELT LOAD	DIST	1-2 PLANE		AXIAL	1-3 PLANE		AXIAL
ID COMB	ENDI	SHEAR	MOMENT	FORCE	SHEAR	MOMENT	TORQ
	192.615	329.327	-12022.930		-6.201	-500.398	
	256.819	603.289	17916.334		-6.201	-898.504	
	256.819			951.204			
81 -----							
1	0.000				12898.187		
	0.000	-5.326	1013.209		216.715	-9409.069	
	68.942	-5.326	646.036		101.465	1558.982	
	137.885	-5.326	278.862		-13.785	4581.416	
	206.827	-5.326	-88.311		-129.035	-341.765	
	275.770	-5.326	-455.485		-244.285	-13210.563	
	275.770				13112.828		
82 -----							
1	0.000				2530.361		
	0.000	-4.605	882.207		222.471	-9126.272	
	68.942	-4.605	564.720		107.221	2238.646	
	137.885	-4.605	247.232		-8.029	5657.947	
	206.827	-4.605	-70.255		-123.279	1131.631	
	275.770	-4.605	-387.743		-238.529	-11340.300	
	275.770				2745.002		
83 -----							
1	0.000				-12943.442		
	0.000	-20.714	4487.507		210.990	-7771.660	
	62.224	-20.714	3198.592		109.570	2201.587	
	124.448	-20.714	1909.677		8.150	5864.089	
	186.672	-20.714	620.762		-93.270	3215.846	
	248.895	-20.714	-668.154		-194.690	-5743.142	
	248.895				-12728.801		

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84	-----					
1	0.000			12898.187		
	0.000	5.326	-1013.209	216.715	-9409.069	
	68.942	5.326	-646.036	101.465	1558.982	
	137.885	5.326	-278.862	-13.785	4581.416	
	206.827	5.326	88.311	-129.035	-341.765	
	275.770	5.326	455.485	-244.285	-13210.563	
	275.770			13112.828		
85	-----					
1	0.000			2530.361		
	0.000	4.605	-882.207	222.471	-9126.272	
	68.942	4.605	-564.720	107.221	2238.646	
	137.885	4.605	-247.232	-8.029	5657.947	
	206.827	4.605	70.255	-123.279	1131.631	
	275.770	4.605	387.743	-238.529	-11340.300	
	275.770			2745.002		
86	-----					
1	0.000			-12943.442		

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STRUKTUR FRAME BAGIAN ATAS KONVEYOR I

FRAME ELEMENT FORCES

ELT LOAD ID COMB	DIST ENDI	1-2 PLANE		AXIAL FORCE	1-3 PLANE		AXIAL TORQ
		SHEAR	MOMENT		SHEAR	MOMENT	
	0.000	20.714	-4487.507	210.990	-7771.660		
	62.224	20.714	-3198.592	109.570	2201.587		
	124.448	20.714	-1909.677	8.150	5864.089		
	186.672	20.714	-620.762	-93.270	3215.846		
	248.895	20.714	668.154	-194.690	-5743.142		
	248.895			-12728.801			
90	-----						
1	0.000			-1263.785			
	0.000	13.712	-1056.587	9.499	-5559.920		
	44.691	13.712	-443.805	-181.197	-9396.587		
	89.382	13.712	168.976	-371.892	-21755.586		
	134.072	13.712	781.757	-562.588	-42636.917		
	178.763	13.712	1394.538	-753.284	-72040.580		
	178.763			-1263.785			
91	-----						
1	0.000			-1263.785			
	0.000	-13.712	1056.587	9.499	-5559.920		
	44.691	-13.712	443.805	-181.197	-9396.587		
	89.382	-13.712	-168.976	-371.892	-21755.586		
	134.072	-13.712	-781.757	-562.588	-42636.917		
	178.763	-13.712	-1394.538	-753.284	-72040.580		
	178.763			-1263.785			



STRUKTUR FRAME BAGIAN ATAS KONVEYOR I

REACTIONS AND APPLIED FORCES

LOAD COMBINATION 1 - FORCES "F" AND MOMENTS "M"

JOINT	F(X)	F(Y)	F(Z)	M(X)	M(Y)	M(Z)
1	0.7227E+04	0.2229E+02	0.1273E+05	0.6418E+04	-0.5075E+06	0.0000E+00
2	-0.1819E-11	0.0000E+00	0.4189E-10	0.2736E-10	0.1159E-09	0.0000E+00
3	-0.5912E-11	0.0000E+00	-0.4241E-10	-0.1276E-09	-0.7924E-10	0.3297E-11
4	0.3155E-11	0.0000E+00	0.6890E-10	0.3009E-10	-0.4759E-09	-0.4007E-11
5	-0.6377E+04	0.0000E+00	0.1103E+05	0.0000E+00	0.9829E+06	0.0000E+00
6	-290.0000	0.0000	0.0000	0.0000	0.0000	0.0000
7	-290.0000	0.0000	0.0000	0.0000	0.0000	0.0000
8	-255.2000	0.0000	0.0000	0.0000	0.0000	0.0000
9	0.0000E+00	0.0000E+00	0.1271E-10	0.0000E+00	0.4218E-10	0.0000E+00
10	0.1728E-10	0.0000E+00	-0.1103E-10	-0.9472E-11	-0.8419E-10	0.0000E+00
11	0.2149E-10	0.0000E+00	-0.6838E-10	0.7035E-11	0.2120E-10	0.2183E-11
12	0.0000E+00	0.0000E+00	-0.2458E-09	0.4004E-11	0.1230E-09	-0.7052E-11
13	0.2395E-11	0.0000E+00	0.1136E-10	-0.4071E-11	0.3820E-10	0.0000E+00
14	-662.5000	0.0000	0.0000	0.0000	0.0000	0.0000
15	-662.5000	0.0000	0.0000	0.0000	0.0000	0.0000
16	-583.0000	0.0000	0.0000	0.0000	0.0000	0.0000
17	-0.2679E-11	0.0000E+00	0.6755E-10	0.0000E+00	0.1069E-10	0.0000E+00
18	0.7227E+04	-0.2229E+02	0.1273E+05	-0.6418E+04	-0.5075E+06	0.0000E+00
19	-0.3979E-11	0.0000E+00	-0.3246E-10	0.4545E-10	0.1573E-09	0.2530E-11
20	0.6935E-11	0.0000E+00	0.9811E-10	0.3654E-10	0.0000E+00	-0.4263E-11
21	0.0000E+00	0.0000E+00	-0.1846E-10	0.3286E-10	-0.2274E-09	-0.1165E-11
22	-0.6377E+04	0.0000E+00	0.1103E+05	0.0000E+00	0.9829E+06	0.0000E+00
23	-290.0000	0.0000	0.0000	0.0000	0.0000	0.0000
24	-290.0000	0.0000	0.0000	0.0000	0.0000	0.0000
25	-255.2000	0.0000	0.0000	0.0000	0.0000	0.0000
26	0.1769E-11	0.0000E+00	-0.3922E-11	-0.1901E-11	0.1990E-10	0.0000E+00
27	0.3354E-10	0.0000E+00	-0.2950E-10	-0.2780E-11	0.2186E-09	0.0000E+00
28	-0.3126E-10	0.0000E+00	-0.2436E-09	-0.1998E-11	-0.6747E-10	-0.2299E-11
29	-0.1910E-10	0.0000E+00	0.9402E-10	-0.2276E-11	0.5144E-11	-0.2453E-11
30	0.1037E-11	0.0000E+00	-0.2780E-10	-0.3993E-11	-0.1683E-10	0.0000E+00
31	-662.5000	0.0000	0.0000	0.0000	0.0000	0.0000
32	-662.5000	0.0000	0.0000	0.0000	0.0000	0.0000
33	-583.0000	0.0000	0.0000	0.0000	0.0000	0.0000
34	0.0000E+00	0.0000E+00	0.1614E-09	0.0000E+00	0.2569E-10	0.0000E+00
35	0.2343E+04	0.1100E+04	0.6862E+04	0.4458E+05	-0.9158E+06	0.1713E+04
36	0.0000E+00	0.0000E+00	0.0000E+00	-0.3799E-10	-0.1456E-09	0.0000E+00
37	0.0000E+00	0.0000E+00	0.1828E-11	-0.8743E-10	0.2295E-09	0.3112E-11
38	0.0000E+00	0.0000E+00	0.1005E-10	0.4344E-10	-0.4648E-09	0.0000E+00
39	-0.4494E+03	0.9554E+03	0.7006E+04	0.5340E+05	0.9528E+06	0.1409E+04
40	0.2343E+04	-0.1100E+04	0.6862E+04	-0.4458E+05	-0.9158E+06	-0.1713E+04
41	0.0000E+00	0.0000E+00	0.7272E-11	-0.3049E-10	-0.4363E-09	-0.1194E-11
42	0.0000E+00	0.0000E+00	-0.2379E-11	0.1576E-09	0.3149E-09	0.0000E+00
43	0.0000E+00	0.0000E+00	0.9972E-11	-0.1842E-10	0.3211E-09	0.0000E+00
44	-0.4494E+03	-0.9554E+03	0.7006E+04	-0.5340E+05	0.9528E+06	-0.1409E+04



Analisis Struktur Rangka Konveyor II dengan Program SAP90

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STRUKTUR FRAME BAGIAN ATAS KONVEYOR II

S Y S T E M D A T A

```

EXECUTION CODE - - - - - 0
NUMBER OF LOAD CONDITIONS - - - - - 2
STEADY STATE LOAD FREQUENCY - - - - - -0.0000E+00
NUMBER OF EIGENVALUES - - - - - 0
EIGEN CONVERGENCE TOLERANCE - - - - - -0.1000E-03
EIGEN CUTOFF TIME PERIOD - - - - - -0.0000E+00
  
```

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STRUKTUR FRAME BAGIAN ATAS KONVEYOR II

G E N E R A T E D J O I N T C O O R D I N A T E S

JOINT	X	Y	Z
1	0.000	0.000	0.000
2	250.000	0.000	0.000
3	500.000	0.000	0.000
4	700.000	0.000	0.000
5	850.000	0.000	0.000
6	0.000	0.000	65.500
7	250.000	0.000	65.500
8	500.000	0.000	65.500
9	700.000	0.000	65.500
10	0.000	0.000	116.400
11	250.000	0.000	116.400
12	500.000	0.000	116.400
13	700.000	0.000	116.400
14	0.000	0.000	133.500
15	250.000	0.000	133.500
16	500.000	0.000	133.500
17	700.000	0.000	133.500
18	0.000	175.000	0.000
19	250.000	175.000	0.000
20	500.000	175.000	0.000
21	700.000	175.000	0.000
22	850.000	175.000	0.000
23	0.000	175.000	65.500
24	250.000	175.000	65.500
25	500.000	175.000	65.500
26	700.000	175.000	65.500
27	0.000	175.000	116.400
28	250.000	175.000	116.400

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29	500.000	175.000	116.400
30	700.000	175.000	116.400
31	0.000	175.000	133.500
32	250.000	175.000	133.500
33	500.000	175.000	133.500
34	700.000	175.000	133.500
35	0.000	-112.500	0.000
36	250.000	-112.500	0.000
37	500.000	-112.500	0.000
38	700.000	-112.500	0.000
39	850.000	-112.500	0.000
40	0.000	267.500	0.000
41	250.000	267.500	0.000
42	500.000	267.500	0.000
43	700.000	267.500	0.000
44	850.000	267.500	0.000

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STRUKTUR FRAME BAGIAN ATAS KONVEYOR II

R E S T R A I N T D A T A

JOINT	RX	RY	RZ	RXX	RYY	RZZ
1	1	1	1	1	1	1
5	1	1	1	1	1	1
18	1	1	1	1	1	1
22	1	1	1	1	1	1
35	1	1	1	1	1	1
39	1	1	1	1	1	1
40	1	1	1	1	1	1
44	1	1	1	1	1	1

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STRUKTUR FRAME BAGIAN ATAS KONVEYOR II

F R A M E C O N T R O L D A T A

NUMBER OF MEMBER SECTION PROPERTIES	6
NUMBER OF SPAN LOADING PATTERNS	2
NUMBER OF MEMBER FORCE OUTPUT STATIONS	5

LOAD	GRAVITATIONAL MULTIPLIERS			TEMPERATURE	PRESTRESS
COND	X	Y	Z	MULTIPLIERS	MULTIPLIERS
1	0.000	0.000	-1.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000

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STRUKTUR FRAME BAGIAN ATAS KONVEYOR II

S E C T I O N P R O P E R T Y D A T A

PROP ID	AREA	TORSIONAL INERTIA	MOMENTS OF INERTIA		SHEAR AREAS	
			I33	I22	A2	A3
1	0.1111E+03	0.00000E+00	0.11690E+05	0.00000E+00	0.1111E+03	0.1111E+03
2	0.240E+02	0.00000E+00	0.92500E+03	0.85300E+02	0.240E+02	0.240E+02
3	0.554E+02	0.00000E+00	0.16800E+04	0.16800E+04	0.554E+02	0.554E+02



Perancangan Deep Drawn Pan Conveyor (Clinker Transport Kapasitas 500 Ton / Jam)

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4	0.116E+02	0.00000E+00	0.14000E+03	0.14000E+03	0.116E+02	0.116E+02
5	0.410E+02	0.00000E+00	0.18040E+03	0.35260E+03	0.410E+02	0.410E+02
6	0.154E+03	0.00000E+00	0.25760E+05	0.90100E+04	0.154E+03	0.154E+03

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STRUKTUR FRAME BAGIAN ATAS KONVEYOR II

M A T E R I A L P R O P E R T Y D A T A

PROP ID	MODULUS OF ELASTICITY	SHEAR MODULUS	WEIGHT PER UNIT LEN	MASS PER UNIT LEN	THERMAL EXPANSION
1	0.2039E+07	0.7842E+06	0.8574E+01	0.8740E+00	0.0000E+00
2	0.2039E+07	0.7842E+06	0.1844E+01	0.1880E+00	0.0000E+00
3	0.2039E+07	0.7842E+06	0.4267E+01	0.4350E+00	0.0000E+00
4	0.2039E+07	0.7842E+06	0.8920E+00	0.9090E-01	0.0000E+00
5	0.2039E+07	0.7842E+06	0.3159E+01	0.3220E+00	0.0000E+00
6	0.2039E+07	0.7842E+06	0.1187E+02	0.1210E+01	0.0000E+00

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STRUKTUR FRAME BAGIAN ATAS KONVEYOR II

S P A N L O A D I N G D A T A

UNIFORM LOAD DATA

PATTERN ID	1-DIR	2-DIR	3-DIR	X-DIR	Y-DIR	Z-DIR
1	0.0000	0.0000	0.0000	0.0000	0.0000	-3.1150
2	0.0000	0.0000	0.0000	0.0000	0.0000	-1.5800

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STRUKTUR FRAME BAGIAN ATAS KONVEYOR II

F R A M E E L E M E N T D A T A

ELT ID	JOINT END-I	JOINT END-J	LOCAL-AXIS N1	LOCAL-AXIS N2	PROPERTY-ID END-I	PROPERTY-ID END-J	VAR	REL CODES	REF TEMP	ELEMENT LENGTH
1	1	2	2	0	1	1	0	000000	0.00	250.00
2	2	3	2	0	1	1	0	000000	0.00	250.00
3	3	4	2	0	1	1	0	000000	0.00	200.00
4	4	5	2	0	1	1	0	000000	0.00	150.00
5	6	7	2	0	5	5	0	000000	0.00	250.00
6	7	8	2	0	5	5	0	000000	0.00	250.00
7	8	9	2	0	5	5	0	000000	0.00	200.00
8	14	15	2	0	5	5	0	000000	0.00	250.00
9	15	16	2	0	5	5	0	000000	0.00	250.00
10	16	17	2	0	5	5	0	000000	0.00	200.00
11	18	19	2	0	1	1	0	000000	0.00	250.00
12	19	20	2	0	1	1	0	000000	0.00	250.00
13	20	21	2	0	1	1	0	000000	0.00	200.00
14	21	22	2	0	1	1	0	000000	0.00	150.00
15	23	24	2	0	5	5	0	000000	0.00	250.00
16	24	25	2	0	5	5	0	000000	0.00	250.00
17	25	26	2	0	5	5	0	000000	0.00	200.00
18	31	32	2	0	5	5	0	000000	0.00	250.00



Perancangan Deep Drawn Pan Conveyor (Clinker Transport Kapasitas 500 Ton / Jam)

Pamuji , Ir. Gregorius Harjanto

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19	32	33	2	0	5	5	0	000000	0.00	250.00
20	33	34	2	0	5	5	0	000000	0.00	200.00
21	1	6	2	0	2	2	0	000000	0.00	65.50
22	2	7	2	0	2	2	0	000000	0.00	65.50
23	3	8	2	0	2	2	0	000000	0.00	65.50
24	4	9	2	0	2	2	0	000000	0.00	65.50
25	6	10	2	0	2	2	0	000000	0.00	50.90
26	7	11	2	0	2	2	0	000000	0.00	50.90
27	8	12	2	0	2	2	0	000000	0.00	50.90
28	9	13	2	0	2	2	0	000000	0.00	50.90
29	10	14	2	0	2	2	0	000000	0.00	17.10
30	11	15	2	0	2	2	0	000000	0.00	17.10
31	12	16	2	0	2	2	0	000000	0.00	17.10
32	13	17	2	0	2	2	0	000000	0.00	17.10
33	18	23	2	0	2	2	0	000000	0.00	65.50
34	19	24	2	0	2	2	0	000000	0.00	65.50
35	20	25	2	0	2	2	0	000000	0.00	65.50
36	21	26	2	0	2	2	0	000000	0.00	65.50
37	23	27	2	0	2	2	0	000000	0.00	50.90
38	24	28	2	0	2	2	0	000000	0.00	50.90
39	25	29	2	0	2	2	0	000000	0.00	50.90
40	26	30	2	0	2	2	0	000000	0.00	50.90
41	27	31	2	0	2	2	0	000000	0.00	17.10
42	28	32	2	0	2	2	0	000000	0.00	17.10
43	29	33	2	0	2	2	0	000000	0.00	17.10
44	30	34	2	0	2	2	0	000000	0.00	17.10
45	1	18	1	0	3	3	0	000000	0.00	175.00
46	2	19	1	0	3	3	0	000000	0.00	175.00
47	3	20	1	0	3	3	0	000000	0.00	175.00
48	4	21	1	0	3	3	0	000000	0.00	175.00
49	10	27	1	0	4	4	0	000000	0.00	175.00
50	11	28	1	0	4	4	0	000000	0.00	175.00
51	12	29	1	0	4	4	0	000000	0.00	175.00

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PROGRAM:SAP90/FILE:PRANG2.SAP

STRUKTUR FRAME BAGIAN ATAS KONVEYOR II

FRAME ELEMENT DATA

ELT ID	JOINT END-I	JOINT END-J	LOCAL-AXIS N1	LOCAL-AXIS N2	PROPERTY-ID END-I	PROPERTY-ID END-J	VAR	REL CODES	REF TEMP	ELEMENT LENGTH
52	13	30	1	0	4	4	0	000000	0.00	175.00
59	1	35	1	0	3	3	0	000000	0.00	112.50
60	2	36	1	0	3	3	0	000000	0.00	112.50
61	3	37	1	0	3	3	0	000000	0.00	112.50
62	4	38	1	0	3	3	0	000000	0.00	112.50
63	18	40	1	0	3	3	0	000000	0.00	92.50
64	19	41	1	0	3	3	0	000000	0.00	92.50
65	20	42	1	0	3	3	0	000000	0.00	92.50
66	21	43	1	0	3	3	0	000000	0.00	92.50
67	35	36	2	0	6	6	0	000000	0.00	250.00
68	36	37	2	0	6	6	0	000000	0.00	250.00
69	37	38	2	0	6	6	0	000000	0.00	200.00
70	38	39	2	0	6	6	0	000000	0.00	150.00
71	40	41	2	0	6	6	0	000000	0.00	250.00



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72	41	42	2	0	6	6	0	000000	0.00	250.00
73	42	43	2	0	6	6	0	000000	0.00	200.00
74	43	44	2	0	6	6	0	000000	0.00	150.00
75	2	35	1	35	3	3	0	000000	0.00	274.15
76	2	37	1	35	3	3	0	000000	0.00	274.15
77	4	37	1	35	3	3	0	000000	0.00	229.47
78	19	40	1	35	3	3	0	000000	0.00	266.56
79	19	42	1	35	3	3	0	000000	0.00	266.56
80	21	42	1	35	3	3	0	000000	0.00	220.35
81	2	10	1	2	2	2	0	000000	0.00	275.77
82	3	11	1	2	2	2	0	000000	0.00	275.77
83	4	12	1	2	2	2	0	000000	0.00	231.41
84	19	27	18	19	2	2	0	000000	0.00	275.77
85	20	28	18	19	2	2	0	000000	0.00	275.77
86	21	29	18	19	2	2	0	000000	0.00	231.41
90	4	39	1	0	3	3	0	000000	0.00	187.50
91	21	44	1	0	3	3	0	000000	0.00	176.23

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PROGRAM:SAP90/FILE:PRANG2.SAP

STRUKTUR FRAME BAGIAN ATAS KONVEYOR II

BEAM SPAN LOADING PATTERNS

ELT ID	LOAD 1	LOAD 2
5	2	0
6	2	0
7	2	0
8	1	0
9	1	0
10	1	0
15	2	0
16	2	0
17	2	0
18	1	0
19	1	0
20	1	0

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STRUKTUR FRAME BAGIAN ATAS KONVEYOR II

TOTAL WEIGHTS AND MASSES

PROP	WEIGHT	MASS
1	14575.8000	1485.8000
2	4856.8968	495.1717
3	14571.6878	1485.5131
4	624.4000	63.6300
5	8845.2000	901.6000
6	20179.0000	2057.0000

TOTAL 63652.9846 6488.7147

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STRUKTUR FRAME BAGIAN ATAS KONVEYOR II



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Perancangan Deep Drawn Pan Conveyor (Clinker Transport Kapasitas 500 Ton / Jam)

Pamuji , Ir. Gregorius Harjanto

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JOINT LOADS

JOINT	LOAD	FX	FY	FZ	MX	MY	MZ
6	2	-0.800E+02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
7	2	-0.800E+02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
23	2	-0.800E+02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
24	2	-0.800E+02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
8	2	-0.640E+02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
25	2	-0.640E+02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
14	2	-0.135E+03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
15	2	-0.135E+03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
31	2	-0.135E+03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
32	2	-0.135E+03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
16	2	-0.108E+03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
33	2	-0.108E+03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

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PROGRAM:SAP90/FILE:PRANG2.SAP

STRUKTUR FRAME BAGIAN ATAS KONVEYOR II

LOAD CONDITION COMBINATION MULTIPLIERS

COMBINATION	CONDITION	FACTOR
1	1	1.000
	2	1.000

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PROGRAM:SAP90/FILE:PRANG2.SAP

STRUKTUR FRAME BAGIAN ATAS KONVEYOR II

OUTPUT FILES CREATED BY PROGRAM

INPUT DATA ECHO	PRANG2.SAP
SOLUTION ERRORS AND WARNINGS	PRANG2.ERR
EQUATION NUMBERING	PRANG2.EQN
DISPLACEMENTS AND REACTIONS	PRANG2.SOL
FRAME ELEMENT FORCES	PRANG2.F3F



STRUKTUR FRAME BAGIAN ATAS KONVEYOR II

FRAME ELEMENT FORCES

ELT ID	LOAD COMB	DIST ENDI	1-2 PLANE		AXIAL FORCE	1-3 PLANE		AXIAL TORQ
			SHEAR	MOMENT		SHEAR	MOMENT	

1								
1	1	0.000			-4671.787			
		0.000	-4017.696	524051.998		0.000	0.000	
		62.500	-3481.821	289692.104		0.000	0.000	
		125.000	-2945.946	88824.396		0.000	0.000	
		187.500	-2410.071	-78551.123		0.000	0.000	
		250.000	-1874.196	-212434.455		0.000	0.000	
		250.000			-4671.787			

2								
1	1	0.000			4034.687			
		0.000	-704.117	-129624.875		0.000	0.000	
		62.500	-168.242	-156886.101		0.000	0.000	
		125.000	367.633	-150655.138		0.000	0.000	
		187.500	903.508	-110931.989		0.000	0.000	
		250.000	1439.383	-37716.652		0.000	0.000	
		250.000			4034.687			

3								
1	1	0.000			4989.787			
		0.000	-1940.069	-50670.769		0.000	0.000	
		50.000	-1511.369	-136956.740		0.000	0.000	
		100.000	-1082.669	-201807.711		0.000	0.000	
		150.000	-653.969	-245223.681		0.000	0.000	
		200.000	-225.269	-267204.652		0.000	0.000	
		200.000			4989.787			

4								
1	1	0.000			-5591.217			
		0.000	8606.075	-398960.322		0.000	0.000	
		37.500	8927.600	-70203.933		0.000	0.000	
		75.000	9249.125	270609.643		0.000	0.000	
		112.500	9570.650	623480.406		0.000	0.000	
		150.000	9892.175	988408.358		0.000	0.000	
		150.000			-5591.217			

5								
1	1	0.000			-2807.712			
		0.000	-639.374	29428.798		-0.468	0.000	
		62.500	-343.186	-1276.211		-0.468	-29.256	
		125.000	-46.999	-13469.500		-0.468	-58.512	
		187.500	249.189	-7151.072		-0.468	-87.768	
		250.000	545.376	17679.076		-0.468	-117.024	
		250.000			-2807.712			

6								
1	1	0.000			-5112.749			
		0.000	-624.495	27862.695		1.399	-117.024	
		62.500	-328.308	-1912.403		1.399	-29.616	
		125.000	-32.120	-13175.783		1.399	57.793	

STRUKTUR FRAME BAGIAN ATAS KONVEYOR II



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FRAME ELEMENT FORCES

ELT ID	LOAD COMB	DIST ENDI	1-2 PLANE		AXIAL FORCE	1-3 PLANE		AXIAL TORQ
			SHEAR	MOMENT		SHEAR	MOMENT	
		187.500	264.067	-5927.445		1.399	145.201	
		250.000	560.255	19832.613		1.399	232.610	
		250.000		-5112.749				
7								
	1	0.000			-1584.341			
		0.000	-394.106	9024.396		-1.163	232.610	
		50.000	-157.156	-4757.136		-1.163	174.457	
		100.000	79.794	-6691.168		-1.163	116.305	
		150.000	316.744	3222.300		-1.163	58.152	
		200.000	553.694	24983.268		-1.163	0.000	
		200.000		-1584.341				
8								
	1	0.000			-7742.899			
		0.000	-857.298	42378.685		0.167	0.000	
		62.500	-465.173	1051.466		0.167	10.434	
		125.000	-73.048	-15767.941		0.167	20.868	
		187.500	319.077	-8079.535		0.167	31.302	
		250.000	711.202	24116.683		0.167	41.736	
		250.000		-7742.899				
9								
	1	0.000			-8872.871			
		0.000	-753.747	29979.852		-0.291	41.736	
		62.500	-361.622	-4875.430		-0.291	23.561	
		125.000	30.503	-15222.899		-0.291	5.386	
		187.500	422.628	-1062.556		-0.291	-12.789	
		250.000	814.753	37605.600		-0.291	-30.964	
		250.000		-8872.871				
10								
	1	0.000			-638.180			
		0.000	-488.448	4711.887		0.155	-30.964	
		50.000	-174.748	-11868.019		0.155	-23.223	
		100.000	138.952	-12762.926		0.155	-15.482	
		150.000	452.652	2027.168		0.155	-7.741	
		200.000	766.352	32502.261		0.155	0.000	
		200.000		-638.180				
11								
	1	0.000			-4397.068			
		0.000	-3957.775	514340.641		0.000	0.000	
		62.500	-3421.900	283725.820		0.000	0.000	
		125.000	-2886.025	86603.187		0.000	0.000	
		187.500	-2350.150	-77027.258		0.000	0.000	
		250.000	-1814.275	-207165.516		0.000	0.000	
		250.000		-4397.068				
12								
	1	0.000			3739.241			

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PROGRAM:SAP90/FILE:PRANG2.F3F

STRUKTUR FRAME BAGIAN ATAS KONVEYOR II

FRAME ELEMENT FORCES



ELT LOAD ID COMB	DIST ENDI	1-2 PLANE		AXIAL FORCE	1-3 PLANE		AXIAL TORQ
		SHEAR	MOMENT		SHEAR	MOMENT	
	0.000	-724.025	-125874.169		0.000	0.000	
	62.500	-188.150	-154379.645		0.000	0.000	
	125.000	347.725	-149392.933		0.000	0.000	
	187.500	883.600	-110914.033		0.000	0.000	
	250.000	1419.475	-38942.946		0.000	0.000	
	250.000			3739.241			
13	1 0.000			4657.491			
	0.000	-1854.424	-52387.079		0.000	0.000	
	50.000	-1425.724	-134390.794		0.000	0.000	
	100.000	-997.024	-194959.509		0.000	0.000	
	150.000	-568.324	-234093.224		0.000	0.000	
	200.000	-139.624	-251791.939		0.000	0.000	
	200.000			4657.491			
14	1 0.000			-5113.609			
	0.000	8259.636	-380510.009		0.000	0.000	
	37.500	8581.161	-64745.076		0.000	0.000	
	75.000	8902.686	263077.046		0.000	0.000	
	112.500	9224.211	602956.354		0.000	0.000	
	150.000	9545.736	954892.850		0.000	0.000	
	150.000			-5113.609			
15	1 0.000			-2767.043			
	0.000	-638.729	29359.716		0.605	0.000	
	62.500	-342.541	-1304.970		0.605	37.800	
	125.000	-46.354	-13457.938		0.605	75.601	
	187.500	249.834	-7099.187		0.605	113.401	
	250.000	546.021	17771.284		0.605	151.202	
	250.000			-2767.043			
16	1 0.000			-5039.096			
	0.000	-624.137	27834.165		-1.674	151.202	
	62.500	-327.949	-1918.524		-1.674	46.592	
	125.000	-31.762	-13159.493		-1.674	-58.018	
	187.500	264.426	-5888.744		-1.674	-162.627	
	250.000	560.613	19893.724		-1.674	-267.237	
	250.000			-5039.096			
17	1 0.000			-1531.079			
	0.000	-395.512	9140.583		1.336	-267.237	
	50.000	-158.562	-4711.258		1.336	-200.428	
	100.000	78.388	-6715.599		1.336	-133.619	
	150.000	315.338	3127.560		1.336	-66.809	
	200.000	552.288	24818.218		1.336	0.000	
	200.000			-1531.079			

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STRUKTUR FRAME BAGIAN ATAS KONVEYOR II

FRAME ELEMENT FORCES

ELT LOAD ID COMB	DIST ENDI	1-2 PLANE		AXIAL FORCE	1-3 PLANE		AXIAL TORQ
		SHEAR	MOMENT		SHEAR	MOMENT	



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18	-----					
1	0.000					-7651.593
	0.000	-856.117	42218.015		-0.048	0.000
	62.500	-463.992	964.636		-0.048	-2.987
	125.000	-71.867	-15780.929		-0.048	-5.974
	187.500	320.258	-8018.682		-0.048	-8.960
	250.000	712.383	24251.377		-0.048	-11.947
	250.000					-7651.593
19	-----					
1	0.000					-8763.857
	0.000	-754.290	30028.989		0.341	-11.947
	62.500	-362.165	-4860.247		0.341	9.338
	125.000	29.960	-15241.670		0.341	30.622
	187.500	422.085	-1115.280		0.341	51.907
	250.000	814.210	37518.922		0.341	73.192
	250.000					-8763.857
20	-----					
1	0.000					-633.971
	0.000	-490.979	4990.918		-0.366	73.192
	50.000	-177.279	-11715.545		-0.366	54.894
	100.000	136.421	-12737.007		-0.366	36.596
	150.000	450.121	1926.530		-0.366	18.298
	200.000	763.821	32275.067		-0.366	0.000
	200.000					-633.971
21	-----					
1	0.000					-6716.101
	0.000	825.422	689.443		18.231	-734.906
	16.375	825.422	14205.735		18.231	-436.368
	32.750	825.422	27722.026		18.231	-137.831
	49.125	825.422	41238.318		18.231	160.707
	65.500	825.422	54754.609		18.231	459.245
	65.500					-6595.319
22	-----					
1	0.000					-4058.148
	0.000	1850.734	-88541.609		32.196	-1998.333
	16.375	1850.734	-58235.839		32.196	-1471.127
	32.750	1850.734	-27930.069		32.196	-943.921
	49.125	1850.734	2375.702		32.196	-416.716
	65.500	1850.734	32681.472		32.196	110.490
	65.500					-3937.366
23	-----					
1	0.000					3462.272
	0.000	-848.960	22295.491		25.053	-1602.239
	16.375	-848.960	8393.763		25.053	-1192.002
	32.750	-848.960	-5507.965		25.053	-781.765

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PROGRAM:SAP90/FILE:PRANG2.F3F

STRUKTUR FRAME BAGIAN ATAS KONVEYOR II

FRAME ELEMENT FORCES

ELT LOAD	DIST	1-2 PLANE		AXIAL	1-3 PLANE		AXIAL
ID	COMB	SHEAR	MOMENT	FORCE	SHEAR	MOMENT	TORQ
	49.125	-848.960	-19409.693		25.053	-371.528	
	65.500	-848.960	-33311.421		25.053	38.709	
	65.500			3583.054			



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24	-----					
1	0.000			-1644.760		
	0.000	-2222.521	131485.794		60.420	-4644.366
	16.375	-2222.521	95092.017		60.420	-3654.989
	32.750	-2222.521	58698.240		60.420	-2665.612
	49.125	-2222.521	22304.463		60.420	-1676.234
	65.500	-2222.521	-14089.314		60.420	-686.857
	65.500			-1523.979		
25	-----					
1	0.000			-5955.945		
	0.000	-2062.289	25325.811		18.699	459.245
	12.725	-2062.289	-916.820		18.699	697.195
	25.450	-2062.289	-27159.452		18.699	935.145
	38.175	-2062.289	-53402.083		18.699	1173.095
	50.900	-2062.289	-79644.714		18.699	1411.045
	50.900			-5862.085		
26	-----					
1	0.000			-2767.495		
	0.000	-534.303	22497.852		30.329	110.490
	12.725	-534.303	15698.852		30.329	496.429
	25.450	-534.303	8899.851		30.329	882.367
	38.175	-534.303	2100.851		30.329	1268.305
	50.900	-534.303	-4698.150		30.329	1654.244
	50.900			-2673.635		
27	-----					
1	0.000			4537.414		
	0.000	2615.447	-22503.204		27.614	38.709
	12.725	2615.447	10778.356		27.614	390.100
	25.450	2615.447	44059.916		27.614	741.491
	38.175	2615.447	77341.475		27.614	1092.882
	50.900	2615.447	110623.035		27.614	1444.273
	50.900			4631.274		
28	-----					
1	0.000			-970.284		
	0.000	-638.180	10893.954		59.257	-686.857
	12.725	-638.180	2773.118		59.257	67.187
	25.450	-638.180	-5347.718		59.257	821.232
	38.175	-638.180	-13468.554		59.257	1575.276
	50.900	-638.180	-21589.390		59.257	2329.321
	50.900			-876.425		
29	-----					
1	0.000			-888.830		

Computer and Structures, Inc.,

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STRUKTUR FRAME BAGIAN ATAS KONVEYOR II

FRAME ELEMENT FORCES

ELT ID	LOAD COMB	DIST ENDI	1-2 PLANE		AXIAL FORCE	1-3 PLANE		AXIAL TORQ
			SHEAR	MOMENT		SHEAR	MOMENT	
		0.000	7877.899	-92333.383		0.167	-2.855	
		4.275	7877.899	-58655.366		0.167	-2.141	
		8.550	7877.899	-24977.349		0.167	-1.427	
		12.825	7877.899	8700.668		0.167	-0.714	
		17.100	7877.899	42378.685		0.167	0.000	
		17.100			-857.298			



UNIVERSITAS
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30	-----					
1	0.000					-1496.481
	0.000	1264.973	-15767.863	-0.458		7.827
	4.275	1264.973	-10360.105	-0.458		5.871
	8.550	1264.973	-4952.347	-0.458		3.914
	12.825	1264.973	455.411	-0.458		1.957
	17.100	1264.973	5863.169	-0.458		0.000
	17.100					-1464.949
31	-----					
1	0.000					-1334.734
	0.000	-8126.692	106072.715	0.446		-7.620
	4.275	-8126.692	71331.108	0.446		-5.715
	8.550	-8126.692	36589.501	0.446		-3.810
	12.825	-8126.692	1847.894	0.446		-1.905
	17.100	-8126.692	-32893.713	0.446		0.000
	17.100					-1303.201
32	-----					
1	0.000					-797.884
	0.000	-638.180	-21589.390	-0.155		2.647
	4.275	-638.180	-24317.608	-0.155		1.986
	8.550	-638.180	-27045.825	-0.155		1.324
	12.825	-638.180	-29774.043	-0.155		0.662
	17.100	-638.180	-32502.261	-0.155		0.000
	17.100					-766.352
33	-----					
1	0.000					-6652.207
	0.000	823.026	194.237	-15.657		573.212
	16.375	823.026	13671.290	-15.657		316.830
	32.750	823.026	27148.343	-15.657		60.449
	49.125	823.026	40625.395	-15.657		-195.932
	65.500	823.026	54102.448	-15.657		-452.313
	65.500					-6531.425
34	-----					
1	0.000					-4046.777
	0.000	1827.972	-87472.704	-32.336		2027.819
	16.375	1827.972	-57539.667	-32.336		1498.314
	32.750	1827.972	-27606.631	-32.336		968.808
	49.125	1827.972	2326.406	-32.336		439.303
	65.500	1827.972	32259.443	-32.336		-90.202
	65.500					-3925.995

Computer and Structures, Inc.,

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STRUKTUR FRAME BAGIAN ATAS KONVEYOR II

FRAME ELEMENT FORCES

ELT	LOAD	DIST	1-2 PLANE		AXIAL	1-3 PLANE		AXIAL
ID	COMB	ENDI	SHEAR	MOMENT	FORCE	SHEAR	MOMENT	TORQ
35	-----							
1	0.000				3383.619			
	0.000		-856.020	22787.745		-21.567	1363.978	
	16.375		-856.020	8770.412		-21.567	1010.815	
	32.750		-856.020	-5246.922		-21.567	657.653	
	49.125		-856.020	-19264.255		-21.567	304.491	
	65.500		-856.020	-33281.589		-21.567	-48.671	
	65.500				3504.401			



36 UNIVERSITAS
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1	0.000				-1639.843	
	0.000	-2165.051	127827.590		-60.382	4713.317
	16.375	-2165.051	92374.887		-60.382	3724.562
	32.750	-2165.051	56922.183		-60.382	2735.807
	49.125	-2165.051	21469.480		-60.382	1747.052
	65.500	-2165.051	-13983.223		-60.382	758.297
	65.500					-1519.061

37

1	0.000				-5892.696	
	0.000	-2024.017	24742.732		-16.262	-452.313
	12.725	-2024.017	-1012.880		-16.262	-659.243
	25.450	-2024.017	-26768.493		-16.262	-866.173
	38.175	-2024.017	-52524.105		-16.262	-1073.103
	50.900	-2024.017	-78279.717		-16.262	-1280.033
	50.900					-5798.836

38

1	0.000				-2755.837	
	0.000	-524.082	22196.562		-30.058	-90.202
	12.725	-524.082	15527.622		-30.058	-472.686
	25.450	-524.082	8858.681		-30.058	-855.169
	38.175	-524.082	2189.741		-30.058	-1237.653
	50.900	-524.082	-4479.200		-30.058	-1620.136
	50.900					-2661.978

39

1	0.000				4460.526	
	0.000	2587.997	-22528.448		-24.577	-48.671
	12.725	2587.997	10403.812		-24.577	-361.415
	25.450	2587.997	43336.072		-24.577	-674.159
	38.175	2587.997	76268.332		-24.577	-986.902
	50.900	2587.997	109200.592		-24.577	-1299.646
	50.900					4554.385

40

1	0.000				-966.772	
	0.000	-633.972	10834.995		-59.046	758.297
	12.725	-633.972	2767.708		-59.046	6.940
	25.450	-633.972	-5299.580		-59.046	-744.418

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STRUKTUR FRAME BAGIAN ATAS KONVEYOR II

FRAME ELEMENT FORCES

ELT LOAD ID COMB	DIST ENDI	1-2 PLANE		AXIAL FORCE	1-3 PLANE		AXIAL TORQ
		SHEAR	MOMENT		SHEAR	MOMENT	
	38.175	-633.972	-13366.867		-59.046	-1495.776	
	50.900	-633.972	-21434.154		-59.046	-2247.133	
	50.900						-872.913

41

1	0.000				-887.649		
	0.000	7786.593	-90932.725		-0.048	0.817	
	4.275	7786.593	-57645.040		-0.048	0.613	
	8.550	7786.593	-24357.355		-0.048	0.409	
	12.825	7786.593	8930.330		-0.048	0.204	
	17.100	7786.593	42218.015		-0.048	0.000	
	17.100						-856.117



42	UNIVERSITAS GADJAH MADA					
1	0.000					
	0.000	1247.264	-15550.606		0.388	-6.641
	4.275	1247.264	-10218.551		0.388	-4.981
	8.550	1247.264	-4886.497		0.388	-3.320
	12.825	1247.264	445.558		0.388	-1.660
	17.100	1247.264	5777.612		0.388	0.000
	17.100					-1466.674
43	-----					
1	0.000					
	0.000	-8021.886	104646.241		-0.707	12.081
	4.275	-8021.886	70352.680		-0.707	9.061
	8.550	-8021.886	36059.118		-0.707	6.041
	12.825	-8021.886	1765.557		-0.707	3.020
	17.100	-8021.886	-32528.004		-0.707	0.000
	17.100					-1305.189
44	-----					
1	0.000					
	0.000	-633.972	-21434.154		0.366	-6.258
	4.275	-633.972	-24144.383		0.366	-4.693
	8.550	-633.972	-26854.611		0.366	-3.129
	12.825	-633.972	-29564.839		0.366	-1.564
	17.100	-633.972	-32275.067		0.366	0.000
	17.100					-763.821
45	-----					
1	0.000					
	0.000	0.000	0.000		373.363	-10889.740
	43.750	0.000	0.000		186.681	1361.217
	87.500	0.000	0.000		0.000	5444.870
	131.250	0.000	0.000		-186.681	1361.217
	175.000	0.000	0.000		-373.362	-10889.740
	175.000					0.000
46	-----					
1	0.000					
						-120.973

Computer and Structures, Inc.,

STRUKTUR FRAME BAGIAN ATAS KONVEYOR II

FRAME ELEMENT FORCES

ELT LOAD ID COMB	DIST ENDI	1-2 PLANE		AXIAL FORCE	1-3 PLANE		AXIAL TORQ
		SHEAR	MOMENT		SHEAR	MOMENT	
	0.000	-1.308	-1528.491		385.222	-1787.763	
	43.750	-1.308	-1585.712		198.541	10982.058	
	87.500	-1.308	-1642.932		11.860	15584.574	
	131.250	-1.308	-1700.152		-174.822	12019.785	
	175.000	-1.308	-1757.373		-361.503	287.691	
	175.000						-120.973
47	-----						
1	0.000						
	0.000	-0.308	-574.445		358.730	-2298.224	
	43.750	-0.308	-587.901		172.049	9312.565	
	87.500	-0.308	-601.357		-14.632	12756.050	
	131.250	-0.308	-614.813		-201.314	8032.230	
	175.000	-0.308	-628.268		-387.995	-4858.895	
	175.000						-1126.222


Perancangan Deep Drawn Pan Conveyor (Clinker Transport Kapasitas 500 Ton / Jam)

Pamuji , Ir. Gregorius Harjanto

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66	UNIVERSITAS GADJAH MADA	-----				
1	0.000					-45.074
	0.000	-137.057	6728.836		-90.183	26596.730
	23.125	-137.057	3559.404		-188.858	23370.315
	46.250	-137.057	389.971		-287.532	17862.055
	69.375	-137.057	-2779.461		-386.207	10071.950
	92.500	-137.057	-5948.894		-484.881	0.000
	92.500					-45.074
67	-----					
1	0.000					-168.383
	0.000	-5758.175	864512.954		16.999	-985.586
	62.500	-5016.300	527810.589		16.999	76.829
	125.000	-4274.425	237475.412		16.999	1139.243
	187.500	-3532.550	-6492.577		16.999	2201.657
	250.000	-2790.675	-204093.379		16.999	3264.071
	250.000					-168.383
68	-----					
1	0.000					-116.063
	0.000	-2491.958	-204093.379		-8.273	-401.323
	62.500	-1750.083	-336657.187		-8.273	-918.361
	125.000	-1008.208	-422853.808		-8.273	-1435.400
	187.500	-266.333	-462683.241		-8.273	-1952.438
	250.000	475.542	-456145.487		-8.273	-2469.476
	250.000					-116.063
69	-----					
1	0.000					239.056

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STRUKTUR FRAME BAGIAN ATAS KONVEYOR II

FRAME ELEMENT FORCES

ELT LOAD ID COMB	DIST ENDI	1-2 PLANE SHEAR MOMENT		AXIAL FORCE	1-3 PLANE SHEAR MOMENT		AXIAL TORQ
	0.000	1773.728	-477926.043		8.473	-1801.156	
	50.000	2367.228	-374402.163		8.473	-1377.520	
	100.000	2960.728	-241203.284		8.473	-953.883	
	150.000	3554.228	-78329.404		8.473	-530.247	
	200.000	4147.728	114219.476		8.473	-106.611	
	200.000			239.056			
70	-----						
1	0.000						155.336
	0.000	4565.606	114219.476		-30.911	4083.757	
	37.500	5010.731	293775.781		-30.911	2924.598	
	75.000	5455.856	490024.274		-30.911	1765.439	
	112.500	5900.981	702964.954		-30.911	606.280	
	150.000	6346.106	932597.822		-30.911	-552.879	
	150.000			155.336			
71	-----						
1	0.000						-146.164
	0.000	-5705.200	854161.239		-29.271	2674.290	
	62.500	-4963.325	520769.831		-29.271	844.874	
	125.000	-4221.450	233745.612		-29.271	-984.542	
	187.500	-3479.575	-6911.421		-29.271	-2813.958	
	250.000	-2737.700	-201201.265		-29.271	-4643.374	
	250.000						-146.164



72	UNIVERSITAS GADJAH MADA					
1	0.000					-50.138
	0.000	-2465.190	-201201.265		1.092	957.219
	62.500	-1723.315	-332092.069		1.092	1025.448
	125.000	-981.440	-416615.685		1.092	1093.677
	187.500	-239.565	-454772.114		1.092	1161.905
	250.000	502.310	-446561.355		1.092	1230.134
	250.000					-50.138
73	-----					
1	0.000					198.955
	0.000	1704.982	-469840.955		2.547	577.124
	50.000	2298.482	-369754.336		2.547	704.454
	100.000	2891.982	-239992.717		2.547	831.784
	150.000	3485.482	-80556.098		2.547	959.113
	200.000	4078.982	108555.521		2.547	1086.443
	200.000					198.955
74	-----					
1	0.000					61.898
	0.000	4563.863	108555.521		47.620	-4862.451
	37.500	5008.988	288046.491		47.620	-3076.693
	75.000	5454.113	484229.648		47.620	-1290.935
	112.500	5899.238	697104.992		47.620	494.823
	150.000	6344.363	926672.524		47.620	2280.581
	150.000					61.898

Computer and Structures, Inc.,

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STRUKTUR FRAME BAGIAN ATAS KONVEYOR II

FRAME ELEMENT FORCES

ELT ID	LOAD COMB	DIST ENDI	1-2 PLANE		AXIAL FORCE	1-3 PLANE		AXIAL TORQ
			SHEAR	MOMENT		SHEAR	MOMENT	
75	-----							
1	0.000							
	0.000				-1825.281			
	68.537		-274.818	-1399.371		5.213	-1204.763	
	137.073		17.628	-10212.835		5.213	-847.462	
	205.610		310.074	1016.934		5.213	-490.160	
	274.146		602.519	32289.935		5.213	-132.859	
	274.146		894.965	83606.168		5.213	224.442	
	274.146				-1825.281			
76	-----							
1	0.000							
	0.000				1505.153			
	68.537		656.856	-15501.615		-1.811	788.690	
	137.073		364.410	19495.443		-1.811	664.604	
	205.610		71.965	34449.269		-1.811	540.518	
	274.146		-220.481	29359.863		-1.811	416.432	
	274.146		-512.927	4227.224		-1.811	292.346	
	274.146				1505.153			
77	-----							
1	0.000							
	0.000				1154.845			
	57.367		-359.282	-9330.809		12.327	-1513.666	
	114.735		-114.496	-22920.512		12.327	-806.508	
	172.102		130.291	-22467.451		12.327	-99.351	
	229.469		375.077	-7971.627		12.327	607.807	
	229.469		619.864	20566.961		12.327	1314.964	
	229.469				1154.845			



Perancangan Deep Drawn Pan Conveyor (Clinker Transport Kapasitas 500 Ton / Jam)

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78	1	0.000				
		0.000	-243.468	-2955.645	-10.126	1924.125
		66.641	40.889	-9705.675	-10.126	1249.306
		133.282	325.246	2494.109	-10.126	574.487
		199.923	609.603	33643.707	-10.126	-100.332
		266.564	893.960	83743.119	-10.126	-775.151
		266.564				
				-2001.678		
79	1	0.000				
		0.000	641.331	-13976.269	5.643	-1345.644
		66.641	356.974	19287.740	5.643	-969.608
		133.282	72.617	33601.936	5.643	-593.571
		199.923	-211.740	28966.318	5.643	-217.535
		266.564	-496.096	5380.886	5.643	158.501
		266.564				
				1633.862		
80	1	0.000				
		0.000	-329.417	-10917.377	-8.896	1003.125
		55.089	-94.354	-22589.868	-8.896	513.030
		110.177	140.710	-21313.014	-8.896	22.934

Computer and Structures, Inc.,

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STRUKTUR FRAME BAGIAN ATAS KONVEYOR II

FRAME ELEMENT FORCES

ELT ID	LOAD COMB	DIST ENDI	1-2 PLANE		AXIAL FORCE	1-3 PLANE		AXIAL TORQ
			SHEAR	MOMENT		SHEAR	MOMENT	
		165.266	375.773	-7086.816		-8.896	-467.162	
		220.355	610.837	20088.728		-8.896	-957.258	
		220.355			1403.643			
81	1	0.000						
		0.000	-6.575	1435.493	219.591	-9680.344		
		68.942	-6.575	982.210	104.341	1485.999		
		137.885	-6.575	528.926	-10.909	4706.726		
		206.827	-6.575	75.642	-126.159	-18.163		
		275.770	-6.575	-377.641	-241.409	-12688.669		
		275.770						
					11078.068			
82	1	0.000						
		0.000	-6.724	1538.355	224.233	-9341.373		
		68.942	-6.724	1074.768	108.983	2144.966		
		137.885	-6.724	611.181	-6.267	5685.689		
		206.827	-6.724	147.594	-121.517	1280.796		
		275.770	-6.724	-315.992	-236.767	-11069.714		
		275.770						
					2095.352			
83	1	0.000						
		0.000	-46.079	9756.421	189.837	-5808.432		
		57.852	-46.079	7090.674	97.637	2506.975		
		115.703	-46.079	4424.927	5.437	5488.463		
		173.555	-46.079	1759.179	-86.763	3136.031		
		231.406	-46.079	-906.568	-178.963	-4550.320		
		231.406						
					-12323.986			



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PROGRAM:SAP90/FILE:PRANG2.SOL

STRUKTUR FRAME BAGIAN ATAS KONVEYOR II

JOINT DISPLACEMENTS

LOAD COMBINATION 1 - DISPLACEMENTS "U" AND ROTATIONS "R"

JOINT	U(X)	U(Y)	U(Z)	R(X)	R(Y)	R(Z)
1	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	-0.005160	0.000673	-0.315115	-0.000214	0.001166	0.000039
3	-0.000704	0.001582	-0.417186	-0.000144	-0.000180	0.000015
4	0.003706	0.000530	-0.256588	-0.000710	-0.001754	0.000003
5	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
6	0.018408	-0.004218	-0.008909	0.000052	0.000963	0.000018
7	0.010014	-0.001427	-0.320466	0.000142	0.000196	-0.000002
8	-0.005272	-0.002063	-0.412471	0.000150	-0.000371	0.000018
9	-0.009061	0.005794	-0.258709	0.000294	0.000285	0.000050
10	0.066351	-0.001127	-0.015055	-0.000222	0.000230	0.000128
11	0.030654	-0.004077	-0.323296	-0.000116	0.000436	0.000101
12	-0.016228	-0.005997	-0.407703	-0.000067	0.000818	0.000257
13	0.007214	-0.006967	-0.259669	0.000054	0.000141	0.000005
14	0.059446	0.002663	-0.015360	-0.000222	0.000003	-0.000021
15	0.036297	-0.002083	-0.323813	-0.000117	0.000391	-0.000014
16	0.009770	-0.004856	-0.408164	-0.000067	0.001149	-0.000012
17	0.008243	-0.007885	-0.259942	0.000054	-0.000105	-0.000017
18	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
19	-0.004857	0.000485	-0.308758	0.000304	0.001143	-0.000045
20	-0.000727	-0.000163	-0.407804	0.000229	-0.000190	-0.000015
21	0.003389	0.000035	-0.248348	0.000862	-0.001706	0.000000
22	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
23	0.017794	0.002908	-0.008823	-0.000023	0.000943	-0.000033
24	0.009521	-0.003041	-0.314093	-0.000060	0.000184	-0.000006
25	-0.005544	-0.004080	-0.403194	-0.000019	-0.000372	-0.000026
26	-0.009206	-0.014330	-0.250462	-0.000169	0.000271	-0.000064
27	0.064665	-0.001313	-0.014903	0.000231	0.000220	-0.000123
28	0.029431	-0.004355	-0.316911	0.000190	0.000423	-0.000093
29	-0.016814	-0.006538	-0.398506	0.000179	0.000797	-0.000263
30	0.006339	-0.007406	-0.251419	0.000049	0.000128	0.000005
31	0.057751	-0.005258	-0.015208	0.000231	0.000000	-0.000009
32	0.034875	-0.007605	-0.317429	0.000190	0.000379	-0.000011
33	0.008673	-0.009588	-0.398967	0.000178	0.001124	0.000000
34	0.007157	-0.008254	-0.251691	0.000050	-0.000116	0.000010
35	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
36	-0.000134	0.000698	-0.274490	-0.000470	0.001277	0.000016
37	-0.000226	0.002735	-0.387740	-0.000429	-0.000588	-0.000004
38	-0.000074	0.000569	-0.143330	-0.001186	-0.001431	-0.000014
39	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
40	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
41	-0.000116	0.000460	-0.270848	0.000480	0.001260	-0.000013
42	-0.000156	-0.001108	-0.382652	0.000362	-0.000576	0.000001
43	-0.000030	-0.000002	-0.142077	0.001303	-0.001415	0.000011
44	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

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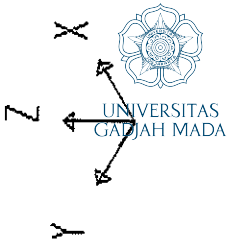
STRUKTUR FRAME BAGIAN ATAS KONVEYOR II



R E A C T I O N S A N D A P P L I E D F O R C E S

LOAD COMBINATION 1 - FORCES "F" AND MOMENTS "M"

JOINT	F(X)	F(Y)	F(Z)	M(X)	M(Y)	M(Z)
1	0.5497E+04	0.1823E+02	0.1135E+05	0.5654E+04	-0.5247E+06	0.0000E+00
2	0.1293E-10	0.0000E+00	-0.2482E-09	0.7396E-10	0.3701E-09	0.0000E+00
3	0.3212E-11	0.0000E+00	-0.1113E-09	-0.1559E-09	0.3257E-09	-0.8740E-11
4	0.5137E-11	0.0000E+00	0.1194E-09	0.2532E-10	-0.1369E-09	0.2899E-11
5	-0.5591E+04	0.0000E+00	0.9892E+04	0.0000E+00	0.9884E+06	0.0000E+00
6	-80.0000	0.0000	0.0000	0.0000	0.0000	0.0000
7	-80.0000	0.0000	0.0000	0.0000	0.0000	0.0000
8	-64.0000	0.0000	0.0000	0.0000	0.0000	0.0000
9	0.1271E-11	0.0000E+00	-0.3482E-10	0.0000E+00	0.5699E-11	0.0000E+00
10	-0.2183E-10	0.0000E+00	0.4533E-11	0.5272E-11	-0.5535E-10	0.4048E-11
11	-0.6423E-11	0.0000E+00	0.6015E-09	0.0000E+00	-0.1795E-09	-0.1604E-11
12	-0.1111E-10	0.0000E+00	-0.1749E-09	0.1108E-11	-0.1185E-09	0.2288E-11
13	0.0000E+00	0.0000E+00	0.1718E-10	0.4075E-11	0.1057E-10	0.0000E+00
14	-135.0000	0.0000	0.0000	0.0000	0.0000	0.0000
15	-135.0000	0.0000	0.0000	0.0000	0.0000	0.0000
16	-108.0000	0.0000	0.0000	0.0000	0.0000	0.0000
17	-0.1933E-11	0.0000E+00	-0.7766E-10	0.3063E-11	0.0000E+00	0.0000E+00
18	0.5220E+04	-0.1566E+02	0.1118E+05	-0.7274E+04	-0.5145E+06	0.0000E+00
19	-0.5286E-11	0.0000E+00	-0.9069E-10	-0.1165E-09	0.4450E-09	-0.3514E-11
20	-0.2132E-11	0.0000E+00	0.2096E-10	0.3428E-09	0.3390E-10	-0.9635E-11
21	-0.4363E-11	0.0000E+00	0.7618E-10	-0.5518E-10	-0.1016E-09	0.0000E+00
22	-0.5114E+04	0.0000E+00	0.9546E+04	0.0000E+00	0.9549E+06	0.0000E+00
23	-80.0000	0.0000	0.0000	0.0000	0.0000	0.0000
24	-80.0000	0.0000	0.0000	0.0000	0.0000	0.0000
25	-64.0000	0.0000	0.0000	0.0000	0.0000	0.0000
26	0.1057E-11	0.0000E+00	-0.5651E-10	-0.1521E-11	0.9385E-10	0.0000E+00
27	0.4516E-10	0.0000E+00	0.2014E-10	0.0000E+00	0.3006E-09	0.5316E-11
28	0.1546E-10	0.0000E+00	-0.3030E-09	0.9059E-11	0.7910E-10	0.0000E+00
29	-0.6168E-11	0.0000E+00	-0.5009E-09	0.1031E-10	0.4011E-10	0.0000E+00
30	0.0000E+00	0.0000E+00	-0.1376E-09	0.6841E-11	-0.5713E-11	0.0000E+00
31	-135.0000	0.0000	0.0000	0.0000	0.0000	0.0000
32	-135.0000	0.0000	0.0000	0.0000	0.0000	0.0000
33	-108.0000	0.0000	0.0000	0.0000	0.0000	0.0000
34	-0.1707E-11	0.0000E+00	0.9037E-10	0.1939E-11	0.8868E-11	0.0000E+00
35	0.1831E+04	0.7708E+03	0.6893E+04	0.3881E+05	-0.9408E+06	0.1210E+04
36	0.0000E+00	0.0000E+00	-0.2273E-11	0.4405E-10	-0.4658E-09	0.0000E+00
37	0.0000E+00	0.0000E+00	-0.6819E-11	-0.1161E-09	-0.5494E-09	-0.3225E-11
38	0.0000E+00	0.0000E+00	-0.1801E-11	0.4338E-10	0.2474E-09	0.0000E+00
39	-0.1131E+04	0.9734E+03	0.7263E+04	0.5663E+05	0.1008E+07	0.1047E+04
40	0.2020E+04	-0.7334E+03	0.6797E+04	-0.3210E+05	-0.9327E+06	-0.3449E+04
41	0.0000E+00	0.0000E+00	0.7269E-11	0.1617E-09	-0.5237E-09	0.2174E-11
42	0.0000E+00	0.0000E+00	0.2059E-11	0.3901E-09	0.1021E-09	-0.8091E-11
43	0.0000E+00	0.0000E+00	0.0000E+00	0.8774E-10	0.7262E-10	-0.2842E-11
44	-0.1529E+04	-0.1013E+04	0.7307E+04	-0.5238E+05	0.1012E+07	0.1157E+04

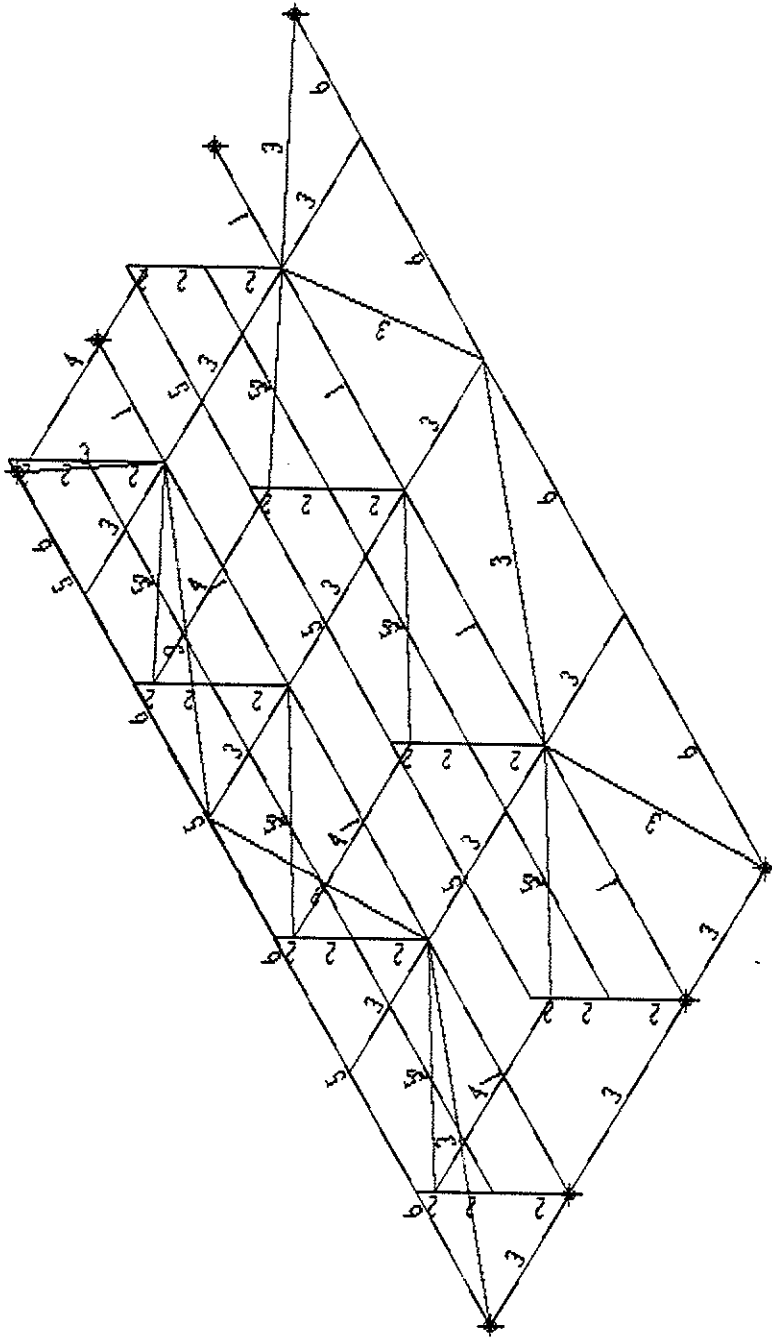


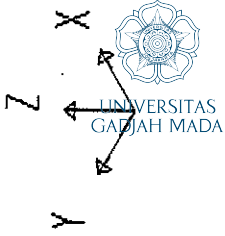
Perancangan Deep Drawn Pan Conveyor (Clinker Transport Kapasitas 500 Ton / Jam)
Pamuji , Ir. Gregorius Harjanto
Universitas Gadjah Mada, 2001 | Diunduh dari <http://etd.repository.ugm.ac.id/>

PRANG 1
UNDEFORMED
SHAPE

OPTIONS
RESTRAINTS
PROPERTY IDS
WIRE FRAME

SAP90



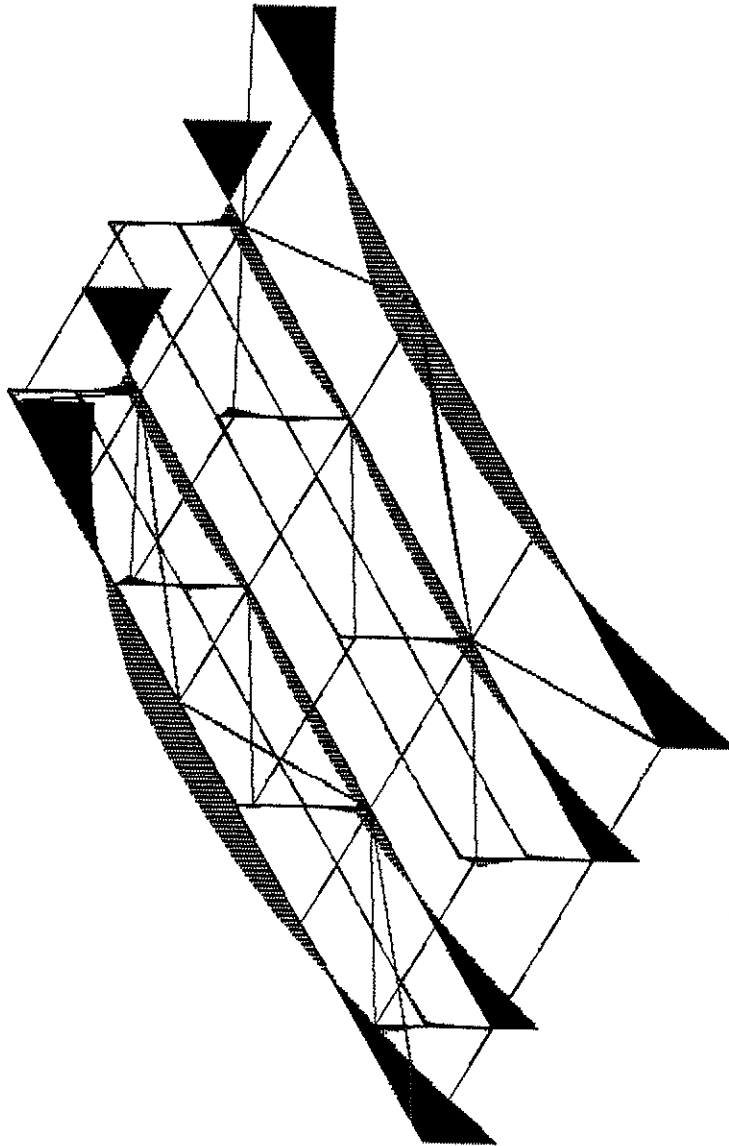


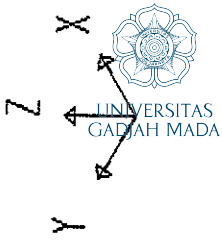
Perancangan Deep Drawn Pan Conveyor (Clinker Transport Kapasitas 500 Ton / Jam)
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PRANGI
FRAME
OUTPUT
LOAD

MIN < 69.000000
-0.45556E+000
AT 0.000000
MAX < 4.000000
0.9829E+000
AT 120.000000

SAP90



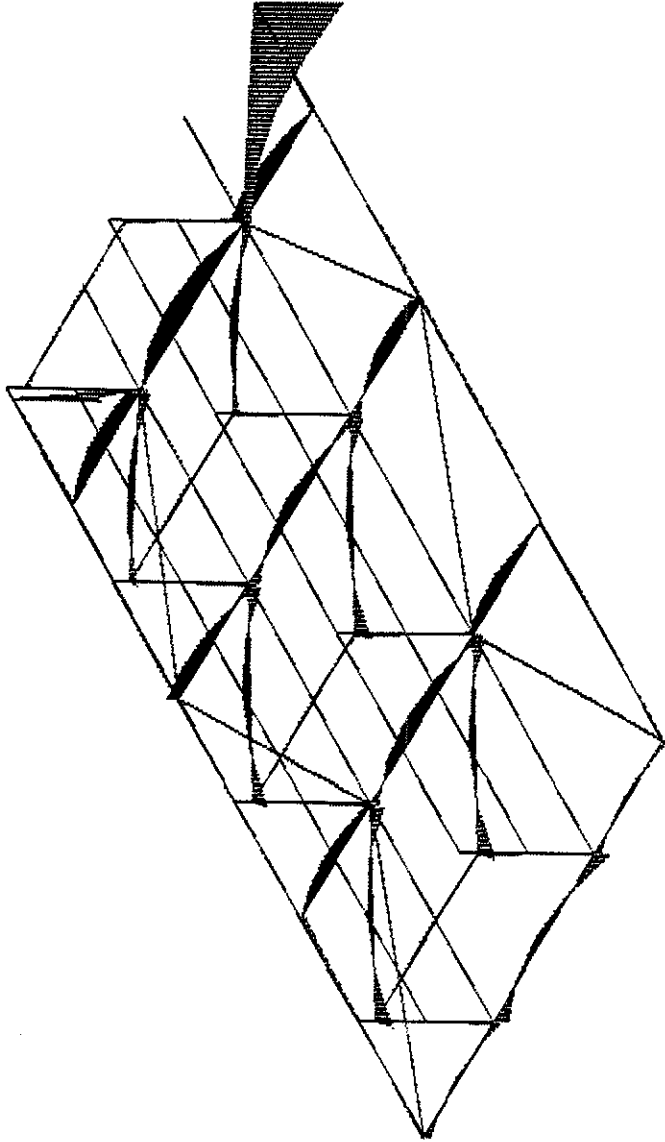


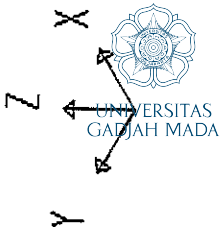
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PRANGI
FRAME
OUTPUT
LOAD

MIN < 90
-0.7204E+0
AT 178.7
MAX < 48
0.1993E+0
AT 97.5

SAP90



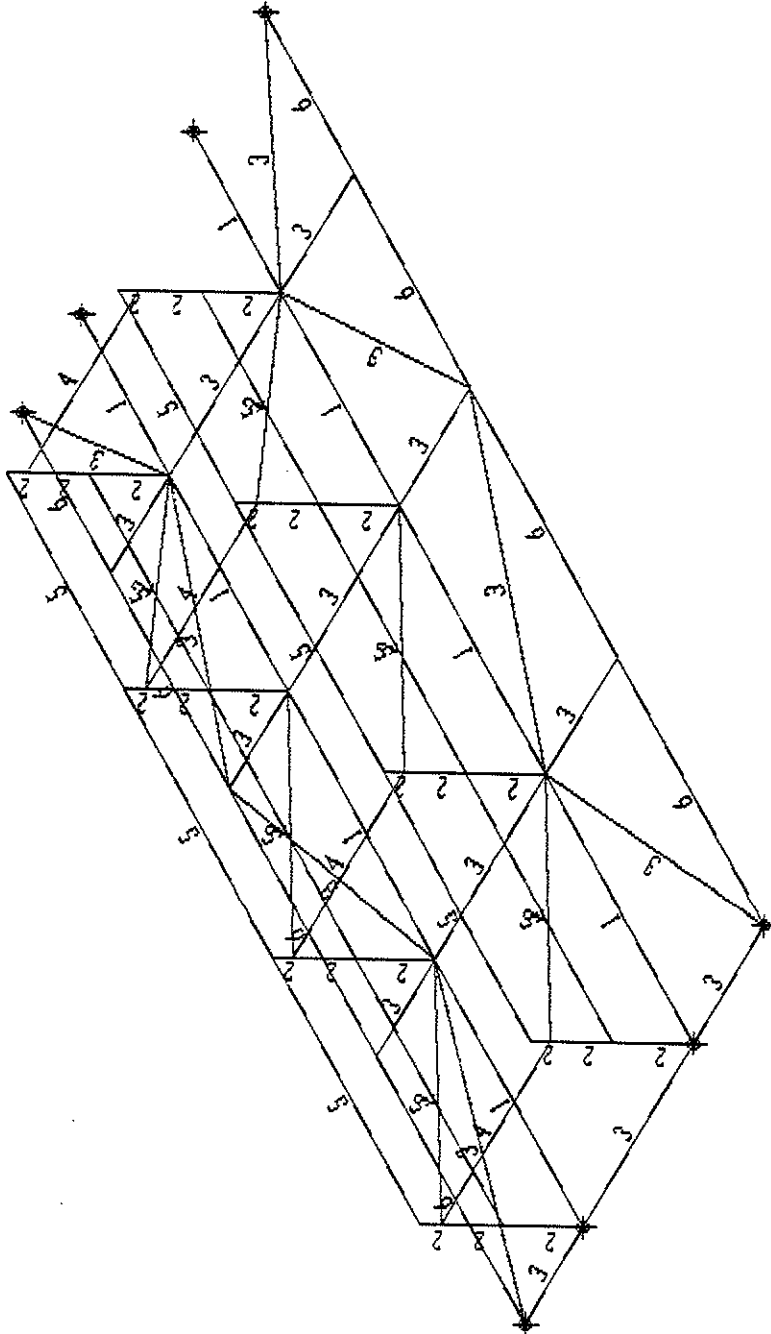


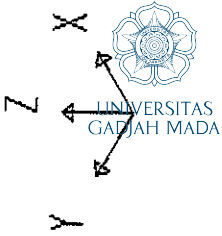
Perancangan Deep Drawn Pan Conveyor (Clinker Transport Kapasitas 500 Ton / Jam)
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PRANG2
UNDEFORM2
SHAPE

OPTIONS
RESTRAINTS
PROPERTY ID
WIRE FRAME

SAP90



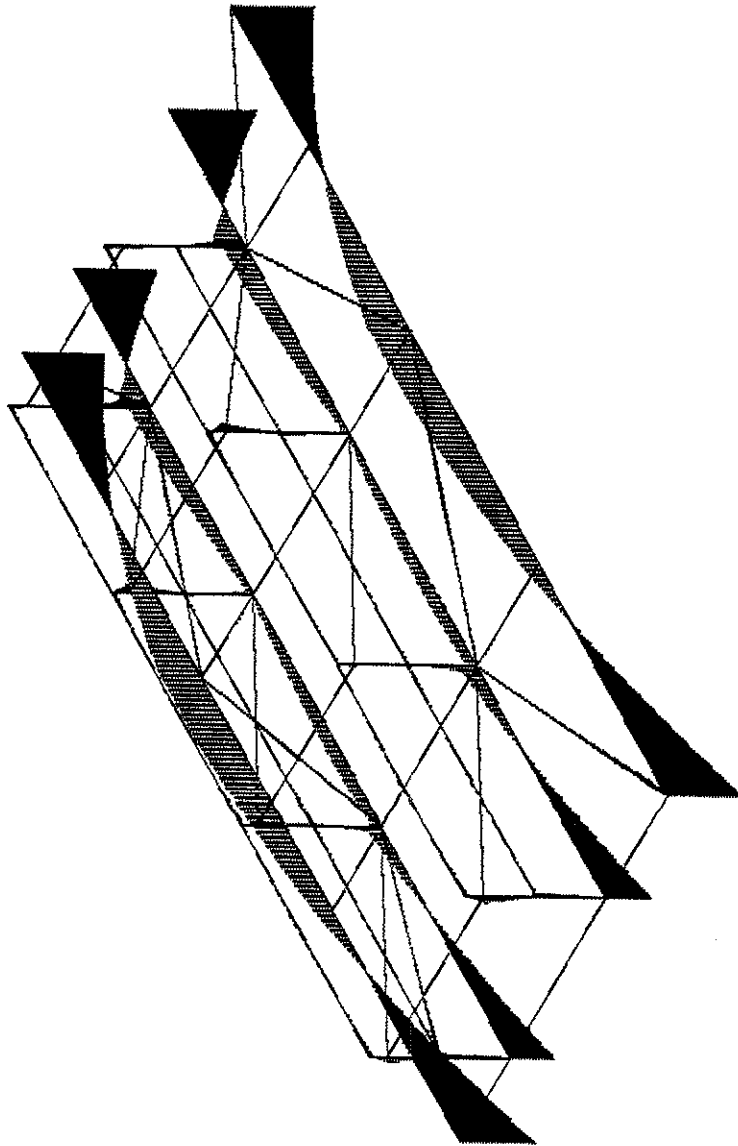


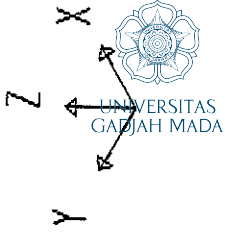
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PRANG2
FRAME
OUTPUT
LOAD

MIN < 69
-0.4779E+00
AT 0.00
MAX < 4.
0.9884E+00
AT 150.00

SAP90



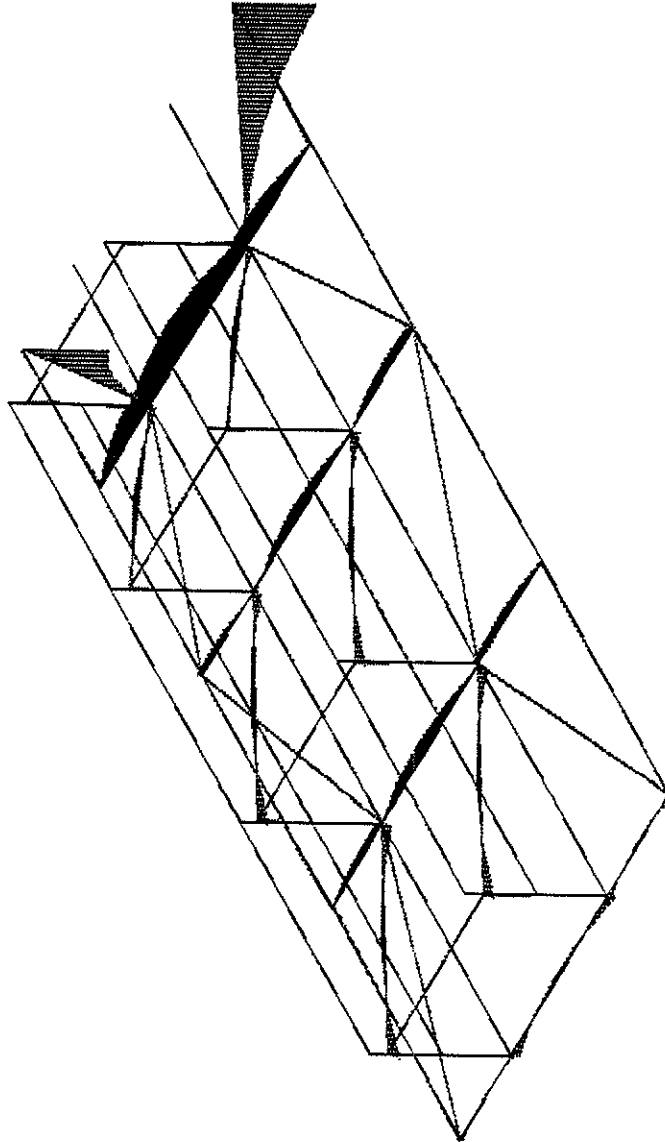


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PRANG2
FRAME
OUTPUT
LOAD

MIN < 91
-0.9978E+0
AT 176.2
MAX < 48
0.3621E+0
AT 87.5

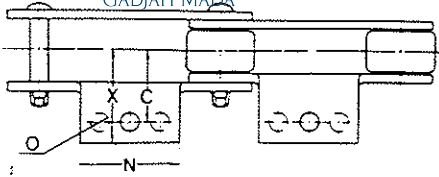
SAP90



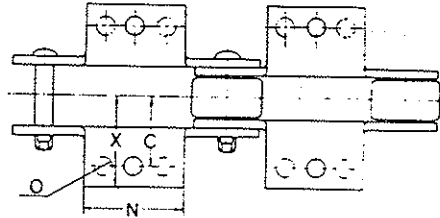


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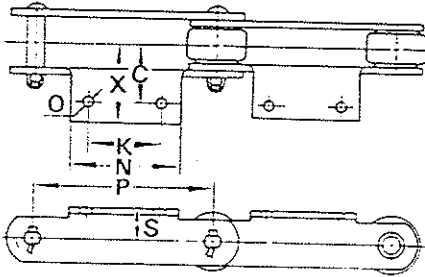
UNIVERSITAS
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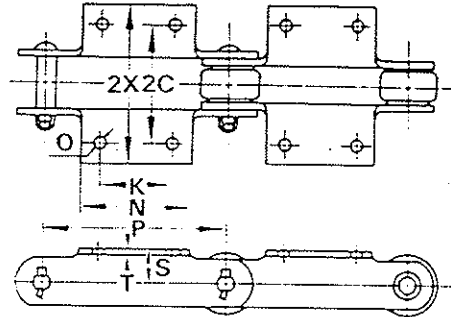
A-1 Attachment*
(See note below)



K-1 Attachment*
(*See note below)



A-2 Attachment



A-2 Attachment

BAKI in No.	Roller Type	Pitch P	Attachment									Size of Bolt	Addition mass. per A- Attachme kg/att.
			S	C	2C	X	2X	K	N	T	O		
03075	R-F-S	75	20	30	60	46	92	30	55	3.2	10	M 8	0.05
03100	R-F-S	100	20	30	60	46	92	40	65	3.2	10	M 8	0.06
430	R-S	101.6	22	40	80	54	108	40	70	4.8 (5.0)	12	M10	0.11
5075	S	75	22	35	70	52	104	30	55	4.5	10	M 8	0.07
5100	R-F-S	100	22	35	70	52	104	40	65	4.5	10	M 8	0.08
5150	R-F-S	150	22	35	70	52	104	60	85	4.5	10	M 8	0.10
204	S	66.27	24	45	90	59	118	-	35	6.3 (6.0)	12	M10	0.08
450	R-F-S-M	101.6	28	50	100	64	128	40	70	6.3 (6.0)	12	M10	0.18
8150	R-F-S-M	150	28	50	100	64	128	60	90	6.3 (6.0)	12	M10	0.22
650	R-F-S-M	152.4	32	50	100	64	128	60	90	6.3 (6.0)	12	M10	0.22
0100	R-S-M	100	28	50	100	65	130	40	70	6.3 (6.0)	12	M10	0.16
0150	R-F-S-M	150	28	50	100	65	130	60	90	6.3 (6.0)	12	M10	0.20
214	R-S-M	101.6	35	55	110	73	146	40	80	7.9	15	M12	0.28
205	S	78.11	35	60	120	75	150	30	65	7.9	12	M10	0.23
6205	R-F-S-M	152.4	38	60	120	79	158	60	100	7.9	15	M12	0.37
2200	R-F-S-M	200	38	60	120	79	158	80	120	7.9	15	M12	0.45
2250	R-F-S-M	250	38	60	120	79	158	125	170	7.9	15	M12	0.62
212	R-S-M	152.4	45	65	130	83	166	60	100	9.5 (10.0)	15	M12	0.49
7200	R-F-S-M	200	45	75	150	98	196	80	120	9.5 (10.0)	15	M12	0.66
7250	R-F-S-M	250	45	75	150	98	196	125	170	9.5 (10.0)	15	M12	0.86

1. Thickness of attachment T in () is for ANSI 300 Series Stainless Steel.
 2. K-attachment is twice as heavy as A-attachment.
 3. RF204 is available only for A-1 / K-1 attachment, and RF205 is available only for A-2 / K-2 attachment.
 4. For DT (Basic Series) A-1 (K-1) attachment with one hole will be supplied in the style of A-3 (K-3) attachment with three holes unless otherwise specified.
 5. The dimensions of the attachment for Bearing Roller Chain are the same as those for the standard attachment.

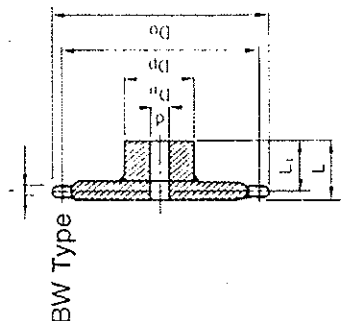


Perancangan Deep Drawn Pan Conveyor (Clinker Transport Kapasitas 500 Ton / Jam)
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TSUBAKI Sprocket No.	No. of teeth	Type	Pitch dia. D_p	Outer dia. D_o	Thickness of tooth T	Bore dia.		Hub dia. DH	Hub length		Approx. mass kg
						Min.	Max.		L	L_1	
RFN03075R-8T	8		196.0	209		20	45	70	61	53	5.0
RFN03075R-10T	10	BW	242.7	255	13	20	50	75	66	58	7.0
RFN03075R-12T	12		289.8	303		20	50	75	66	58	9.0
RFN05100R-8T	8		261.3	273		25	65	100	84	74.5	12.0
RFN05100R-10T	10	BW	323.6	340	17	25	65	100	84	74.5	16.5
RFN05100R-12T	12		386.4	402		25	75	110	94	84.5	23.5
RFN10150R-8T	8		392.0	410		30	85	130	110	97.5	33.0
RFN10150R-10T	10	BW	485.4	503	23	36	95	140	120	107.5	47.5
RFN10150R-12T	12		579.6	600		35	100	150	125	112.5	67.0
RFN12200R-8T	8		522.6	549		40	110	160	135	110	65
RFN12200R-10T	10	BW	647.2	673	29	45	120	180	150	125	102
RFN12200R-12T	12		772.7	799		45	130	190	160	135	141
RFN17200R-8T	8		522.6	555		45	120	180	150	118	90
RFN17200R-10T	10	BW	647.2	679	42	45	130	190	160	128	134
RFN17200R-12T	12		772.7	805		50	145	210	180	148	192
RFN26250R-8T	8		653.3	693		50	145	210	180	144	156
RFN26250R-10T	10	BW	809	849	47	50	145	210	180	144	224
RFN26250R-12T	12		965.9	1006		50	160	230	200	164	315
RFN36300R-8T	8		783.9	834		60	175	250	220	178	269
RFN36300R-10T	10	BW	970.8	1021	57	70	190	270	240	198	397
RFN36300R-12T	12		1159.1	1209		80	210	300	260	218	563

Notes: 1. Sprockets with other sizes of hub and induction hardened teeth are also available.
 2. If the sprocket mass is more than 30 kg, it may have holes for handling.



BW Type

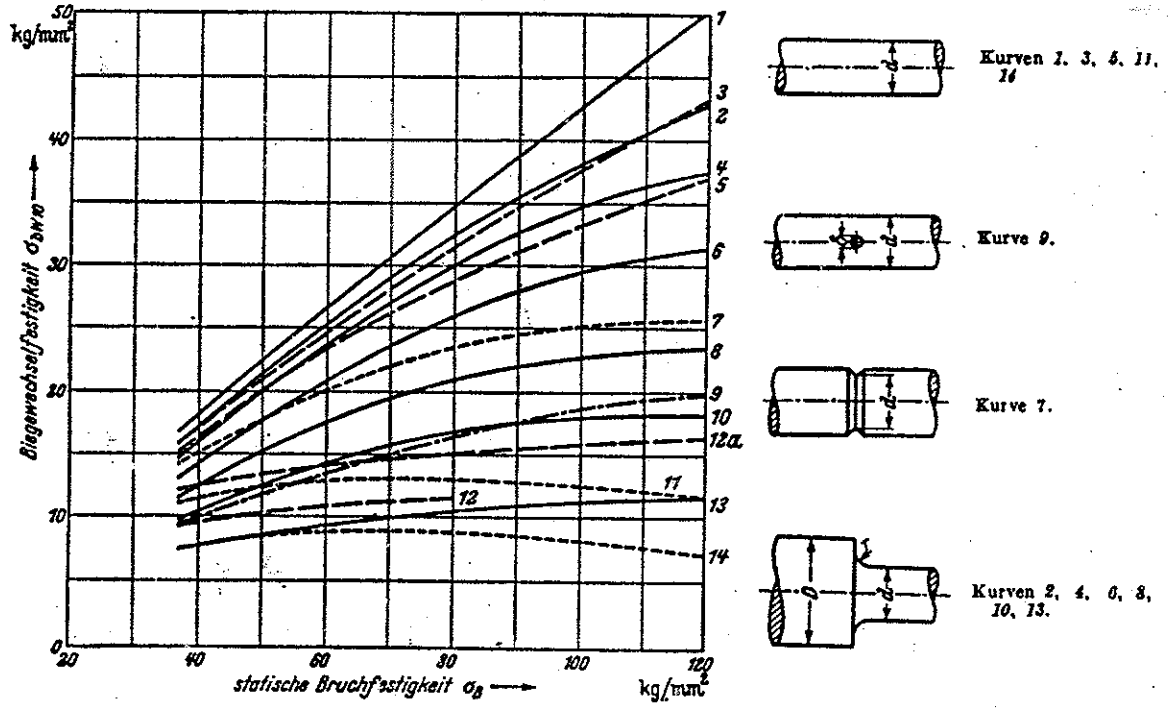


Fig. 3/27.* Relation between endurance strength for reversed bending of 10 mm dia. C-steel test pieces and the static ultimate strength σ_b . (a) Smooth shafts: Polished (curve 1); ground or fine machined (curve 3); rough machined (5), corroded by ordinary water (11); corroded by salt water (14); (b) With transverse hole: $\delta = 0.175 d$ (curve 9); (c) With sharp notch: 1 mm deep (curve 7); (d) With hub: keyed (curve 12); pressed without key (12a); (e) With step $D/d = 2$: $y = r/d = 0.5$ (curve 2); $= 0.3(4)$; $= 0.2(6)$; $= 0.1(8)$; $= 0.05(10)$; $= 0(13)$; (f) For steps with other D/d ratios: Substitute $y = r/d + q$. (g) For other diameters d :** $\sigma_{bw} \approx \sigma_{bw10} \cdot b_0$ and $\tau_{tw} \approx \tau_{tw10} \cdot b_0$.

statische Bruchfestigkeit = static ultimate stress; Biegewechselfestigkeit = endurance strength for reversed bending; Kurve(n) = curve(s).

* The diagram is based on test data of Thum and Lehr.
**After the initial tests of Lehr and Bautz; see footnote 5 on p. 61 for reason.

Example: Stepped shaft, $\sigma_b = 60$; $D/d = 70/50 = 1.4$; $r/d = 5/50 = 0.1$; From table $q = 0.04$, also $= 0.1 + 0.04 = 0.14$.

interpolating between curves 6 and 8: $\sigma_{bw10} = 19 \text{ kgf/mm}^2$.
For $d = 50 \text{ mm}$, $\sigma_{bw} = \sigma_{bw10} \cdot b_0 = 19.07 = 13.3 \text{ kgf/mm}^2$.

$D/d =$	1,05	1,1	1,2	1,3	1,4	1,6
$q =$	0,13	0,1	0,07	0,052	0,04	0,022
$d = 10$	20	30	50	100	200	300 mm
$b_0 = 1$	0,9	0,8	0,7	0,6	0,57	0,56



Table 22/12. Guidance on lubrication and gear quality, tooth errors f_e and f_x

Peripheral velocity v [m/sec]	Lubrication	Tooth surfaces	Quality DIN 3962	Factors		Surface roughness R_a [μm]
				g_e	g_x	
0 ... 0,8	Grease application	cast	12	16	4	
		coarsely cut out	11	10	3,2	
			10	6,3	2,6	
0,8 ... 4	Grease or splash lubrication	finish machined	9	4	2,0	6 ... 9
		coarse ground	8	2,8	1,6	
4 ... 12	Splash lubrication	fine finished	7	2	1,3	3 ... 5
		shaved	6	1,4	1,0	2 ... 3
12 ... 60	Spray lubrication	fine ground	5	1	0,8	1,5 ... 2
		master gear	4	0,7	0,64	

*The surface roughness is not specified in DIN 3962 even though it has a great effect on the surface load capacity (see the footnote referred to at the end of item (a) "pitting" in section 21.5.2). For the combination of tooth surfaces 1 and 2, $R_{\Sigma} = 0.5 (R_{a1} + R_{a2})$.

Note: Base pitch error from DIN 3961: $f_e \leq g_e (3 + 0.3 m + 0.2 \sqrt{d_n})$ [μ]; tooth-directional error as per the suggestion of FZG: $f_x \leq g_x \sqrt{b}$ [μ]; b = face width [mm]. Effective tooth-directional error (after good running-in): $f_{xw} \approx 0.75 f_x + g_x u C_s$ with $g_x = 0$ for straddle mounted spur and helical gears, = 0.3 for overhanging spur and helical gears, = 1.2 for overhanging bevel gears without crowning of the tooth surfaces, = 0.6 with crowning, = 0.3 with crowning and straddle mounting of the bevel pinion.

Table 22/13. Guidance on the necessary safety factor

Factor of safety against	Long life gearing	Finite life gearing
Tooth breakage $S_b \geq$	1,8 ... 4	1,5 ... 2
Pitting S_G	1,3 ... 2,5	0,4 ... 1
Scoring S_f	3 ... 5	3 ... 5

Table 22/14. Guidance on full-load life L_n

Finite life gearing	L_n [hours]		
Machine tools	100 ... ∞		
Lifting equipment:			
Hand winches, electric hoists	10 ... 80		
Piece goods winches	40 ... 200		
Grab winches	320 ... ∞		
	Passenger vehicles	Goods vehicles	Tractors
Automobiles:			
First and reverse gears	10 ... 40	40 ... 200	200 ...
Higher gears	∞	∞	∞



Table 22/18. Guidance for the selection of the shock factor C_s ¹

Driven machine	Driving machine		
	Electric motor	Turbine, multi-cylinder engine	Single cylinder engine
Generators, feeding mechanisms, belt conveyors, light hoists, turbo-blowers and compressors, agitators and mixers for uniform density	1,1	1,25	1,5
Main drives of machine tools, heavy hoists, crane rotary drives, mine ventilators, agitators and mixers for non-uniform density, multicylinder piston pumps, distribution pumps	1,25	1,5	1,75
Presses, shears, dough mills, rolling mills and steel works machinery, power shovels, heavy centrifuges, heavy distribution pumps	1,75	2,0	2,25

¹ $C_s = M_{actual}/M_1$, where M_{actual} is the repeatedly applied maximum external torque and M_1 is the nominal torque of the calculation. If the starting torque M_s is the deciding torque, $M_{actual} = M_s$ is to be calculated as in section 20.4.8.

Table 22/19. Load distribution factor C_T for $T = C_s f_{rw} b / (U C_s C_D)$, from section 22.2.4

$C_s \approx 1$ for the combination St/St; ≈ 0.74 for St/CI; ≈ 0.55 for CI/CI; f_{rw} from Table 22/12;
 C_T (lin) for linear load distribution (use when C_T (par) is not ensured);
 C_T (par) for parabolic load distribution (after the best running-in under load).

T	0	0,2	0,3	0,4	0,5	1,0	1,5	2,0	2,5	3,0	4,0	5,0	6	7
C_T (lin) =	1,0	1,1	1,15	1,20	1,25	1,5	1,75	2,0	2,24	2,45	2,83	3,17	3,47	3,75
C_T (par) =	1,0	1,05	1,075	1,10	1,125	1,25	1,41	1,63	1,82	2,0	2,31	2,59	2,83	3,05

Table 22/20. Determination of f_{rw} and C_T for the operating peripheral force $U C_s C_D$ when the load carrying face width b' (at the rolling circle) is known from the "tooth contact marking" at the peripheral force U_p

Take from Table 22/20: T_p for $(b/b')^2$; $f_{rw} = T_p U_p / (C_s b)$
 Take from Table 22/19: C_T for $T = T_p U_p / (U C_s C_D)$

T_p (lin) is valid for linear load distribution over b'
 T_p (par) is valid for parabolic load distribution over b' } $T_p = C_s f_{rw} b / U_p$

Example: For $(b/b')^2 = 3$; $U_p / (b C_s) = 4$ kgf/mm; $U / (b C_s C_D) = 16$, we obtain T_p (lin) = 6, $f_{rw} = 24 \mu$; $T = 1.5$; C_T (lin) = 1.75.

$(b/b')^2$	1	1,2	1,3	1,4	1,5	2	2,5	3	4	5	6	7	8	9
T_p (lin) =	upto 2	2,4	2,6	2,8	3	4	5	6	8	10	12	14	16	18
T_p (par) =	upto 1,33	1,6	1,73	1,86	2	2,68	3,33	4	5,33	6,66	8	9,33	10,7	12

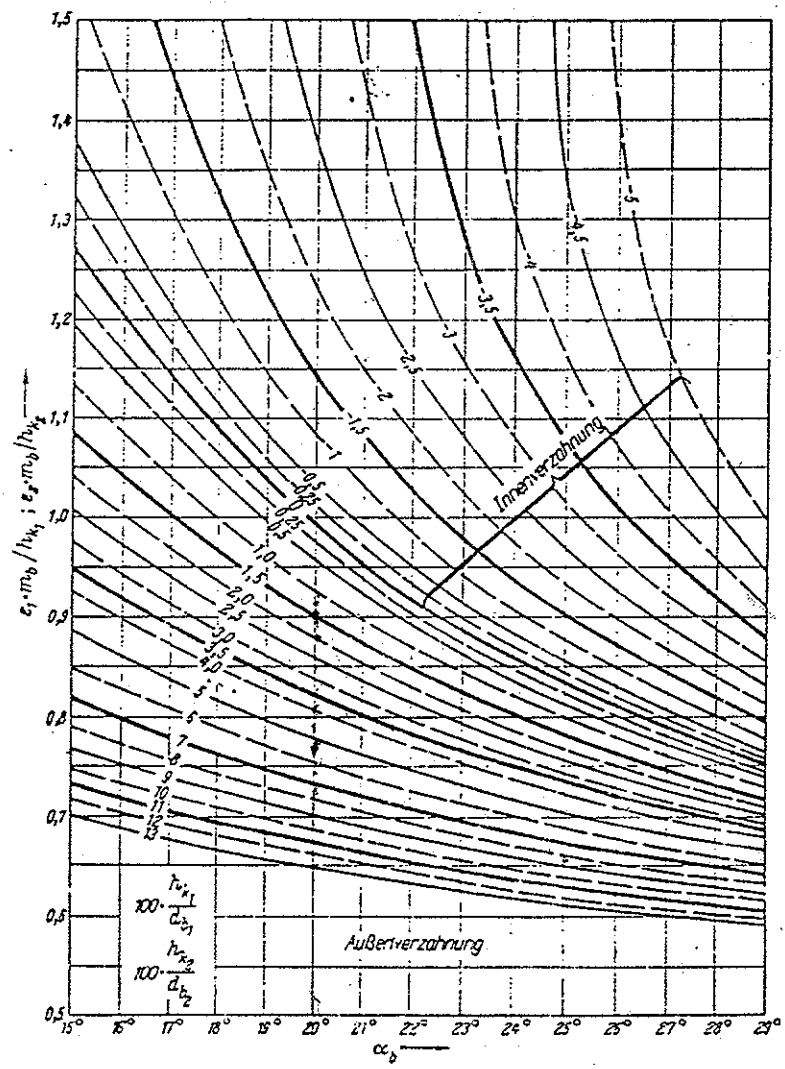


Fig. 22/39. Contact ratio $\epsilon = \epsilon_1 + \epsilon_2$ in transverse section and $\epsilon_n = \epsilon / \cos^2 \beta_x$ in normal section. ϵ_1 and ϵ_2 from the diagram with $m_b = d_{b1}/z_1 = d_{b2}/z_2$ and $h_{k1} = 0.5 (d_{k1} - d_{b1})$ and $h_{k2} = 0.5 (d_{k2} - d_{b2})$.

Equation for diagram:
$$c_1 \frac{m_b}{h_{k1}} = \frac{d_{b1} (\tan \alpha_{k1} - \tan \alpha_b)}{2 \pi h_{k1}}$$

α_{k1} from $\cos \alpha_{k1} = (\cos \alpha_b) d_{b1}/d_{k1}$; α_b from $\sin \alpha_b = \sin \alpha_m / \cos \beta_x$.
Innenverzahnung = internal teeth; Außenverzahnung = external teeth.

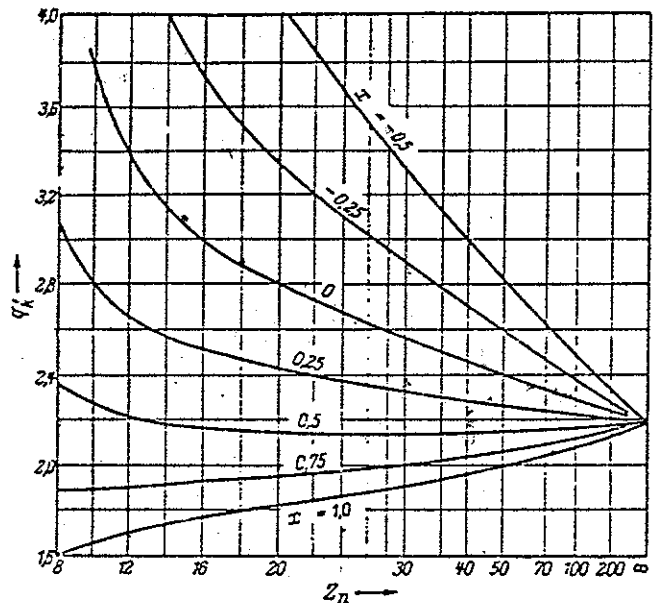


Fig. 22/40. Root factor q_k . Valid for force application at tip for $2.25 m_x$ whole depth; $\alpha_{ex} = 20^\circ$; zero backlash; critical section at point of contact of 30° tangent; generation by rack with $0.38 m_x$ tip rounding and radial clearance $s_x = 0.25 m_x$.

Table 22/22. Factors q_c and y_c

Gear 1 is the driver:

$$q_{c1} = 1,4/(\epsilon_n + 0,4)$$

$$q_{c2} = 1,4/(\epsilon_w + 0,4)$$

$$y_c = 1 - \frac{2 \pi}{z_{1n} \operatorname{tg} \alpha_{bn}} \left(1 - \epsilon_{1n} \frac{\epsilon_w}{\epsilon_n} \right) \leq 1$$

Gear 2 is the driver:

$$q_{c1} = 1,4/(\epsilon_w + 0,4)$$

$$q_{c2} = 1,4/(\epsilon_n + 0,4)$$

$$y_c = 1 - \frac{2 \pi}{z_{1n} \operatorname{tg} \alpha_{bn}} (1 - \epsilon_{1n}) \leq 1$$

z_n = Normal contact ratio from Fig. 22/39

$$\epsilon_w = 1 + (\epsilon_n - 1) \frac{m_n + v/4}{m_n + //6} \leq 2$$

with v in [m/sec]; m_n in [mm] and f in [μ] = highest of the tooth errors f_p, f_p, f_i .

Table 22/23.
Factor y_c

α_{in}	y_c eq. 22/72
10°	5,85
11	5,34
12	4,91
13	4,56
14	4,26
15°	4,00
16	3,77
17	3,58
18	3,40
19	3,25
20°	3,11
21	2,99
22	2,88
23	2,78
24	2,69
25°	2,61
26	2,54
27	2,47
28	2,41
29	2,36
30°	2,31
31	2,27
32	2,23
33	2,19
34	2,16
35°	2,13

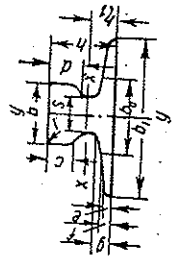


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Table 22/23. Material data** (conversion for other operating conditions is given in Tables 22/26, 27, Figs. 22/41, 42)

No.	Material		Test piece in the final condition		On the gear ¹				Surface Roughness R_a μm	
	Type and Treatment	Designation	σ_s	σ_{-1}	BHN (H_v)		Endurance strength			Static strength $\sigma_{0.2}$
			kgf/mm ²	kgf/mm ²	Core	Surface	k_s ³	σ_{H1} ⁴		
1	Grey cast iron	GG 18	18	9	170		0,19	4,5	18	6,0
2		GG 26	26	12	210		0,33	6,0	26	
3	Malleable cast iron	ferritic	60	—	170		0,32	25	100	6,0
4		pearlitic	70... 75	—	250		0,64	25	140	
5	Cast steel	GS 52	52	21	150		0,21	15	47	4,5
6		GS 60	60	24	175		0,30	17,5	52	
8	Machine steel	St 50.11	50... 60	23... 29	150		0,36	19	55	3,0
9		St 60.11	60... 70	28... 33	180		0,62	21	65	
10		St 70.11	70... 85	33... 40	208		0,70	24	80	
11	Quenched and tempered steel	C 22	50... 60	22... 27	140		0,23	19,3	60	3,0
12		C 45	65... 80	30... 34	185		0,40	23	80	
13		C 60	75... 90	34... 41	210		0,51	25,6	90	
14		34 Cr 4	75... 90	38... 44	260		0,80	30	90	
15		37 Mn Si 5	80... 95	38... 46	260		0,70	31,5	95	
16		42 CrMo 4	95... 110	48... 54	300		0,80	31,5	110	
18	Case-carburized steel	C 15	50... 65	27	190	736	4,9	22	95	2...3
19		16 MnCr 5	80... 110	—	270	650	5,0	42	140	
20		20 MnCr 5	100... 130	—	360	650	5,0	47	160	
21		15 CrNi 6	90... 120	—	310	650	5,0	44	160	
22		18 CrNi 5	120... 145	—	400	650	5,0	47	170	
23	Flame or induction hardened steel	Ck 45	65... 80	—	220	595	4,3	31,5	140	3,0
24		37 MnSi 5	90... 106	—	270	560	3,7	34	125	
25		53 MnSi 4	90... 110	—	275	615	4,5	35	110	
27	Cyanided steel	41 Cr 4	140... 180	—	460	595	4,3	32	190	3,0
28		37 MnSi 5	150... 190	—	470	550	3,6	35	200	
29	Laminated, plastic	coarse	—	—	—	—	0,18	5,6	17	6,0
30		fine	—	—	—	—	0,23	5,6	17	4,0
31	S.G. iron	GGG 90	80... 90	—	300		1,8	22	140	3,0
32	Bath-nitrided steel	C 45	55 ÷ 60	—	450		1,8	31,8	110	
33	Bath-nitrided steel	42 CrMo 4	85 ÷ 90	—	660		2,7	58,0	150	
34	Gas-nitrided steel	31 CrMoV 9	70 ÷ 85	—	700		3,5	45,0	150	
35	Flame or induction hardened steel	42 CrMo 4	90 ÷ 110	—	275	615	4,5	35	110	

¹The test gears were mostly of the following dimensions: $m = 3$ mm; $z_1 = 27$, $z_2 = 34$, $b = 10$ mm; 20°-Standard teeth; $v = 8$ m/sec. Influences on load capacity are considered in sections 22.2.8 and 21.6.
²Up to 35% higher values if meshing with a case-hardened and fine-ground steel gear.
³For $v = 12$ m/sec and ground steel mating gear.
⁴Valid for fillet radius of curvature $r_f \geq 0.2$ m.
⁵Valid for case hardening beyond the root fillet; about 20% lower if through-hardened; $\sigma_s < 25$ kgf/mm² if case-hardened on the tooth flank only.
⁶Corresponds to the currently used C-value = $U/bt = 0.8$ kgf/mm².
⁷For running with a mating steel gear of about the same hardness, oil of viscosity 100 cSt and surface roughness given in the table.
⁸For the combination of tooth surfaces 1 and 2, $R_t = 0.5 (R_{t1} + R_{t2})$; effect of R_t on k_s is considered in the footnote referred to at the end of item (a), "pitting" in section 21.5.2.
⁹The materials 31 to 35 are newly included in the second reprint and materials 7, 17 and 26, which are very little used, are omitted.



Bentuk No.	UKURAN, mm											Berat per meter roda sorong, kg
	h	b	c	d	s	r	b ₁	b ₀	e	f	g	
1	55	45	20	23,5	24	3	125	54	8	11	14,5	22,5
2	65	55	25	28,5	31	4	150	66	9	12,5	17,5	32,2
3	75	65	30	34,0	38	5	175	78	10	14,0	20,0	43,8
4	85	75	35	39,5	45	6	200	90	11	15,5	22,0	57,0

Table 22/26. Surface strength k_D and full-load life L_n

$$k_D = y_0 y_H y_S y_p k_0$$

Factor $y_0 = 1$ for running of the material of Table 22/25 with steel

$$y_e = 1.5 \text{ for running with cast iron}$$

$$y_0 = 0.5 + 2.1 \times 10^{-4} / (2 E_0) \text{ for running with a material of modulus of elasticity } E_0$$

$$y_H = (H/H_0)^3 \text{ when the surface hardness } H \text{ is different from the } H_0 \text{ of Table 22/25 and remains within } 650; \text{ otherwise } y_H = 1.$$

y_s : function of oil viscosity V at the operating temperature

$$V [\text{cSt}] = 6,3 \quad 21 \quad 37 \quad 68$$

$$y_s = 0,7 \quad 0,75 \quad 0,8 \quad 0,9$$

$$V = 100 \cdot 145 \quad 200 \quad 265 \quad 300$$

$$y_s = 1,0 \quad 1,1 \quad 1,2 \quad 1,3 \quad 1,35$$

y_p : function of peripheral velocity v [m/sec]

$$y_p \approx 0,7 + \frac{0,6}{1 + (8/v)^2}$$

Tabel 37
Karakteristik Penampang Rel dan Beban Roda Maksimum yang Dizinkan

Bentuk no.	Potongan melintang luas T , cm ²		Jarak ke pusat berat η , mm		Momen Inersia		Momen resistensi		Beban roda maksimum P_{maks} , kg pada*		
	I_x , cm ⁴	I_y , cm ⁴	W_x , cm ³	W_y , cm ³	W_x , cm ³	W_y , cm ³	W_x , m ³	W_y , m ³	40	50	60
1	28,7	94,05	22,7	29,12	182,4	29,18	29,18	29,18	6,240	7,800	9,360
2	41,01	180,4	26,8	47,2	352,6	47,0	47,0	47,0	11,280	14,100	16,920
3	55,8	328,6	30,6	74,0	646,12	73,8	73,8	73,8	17,600	22,000	26,400
4	72,6	523,4	35,2	105,1	988,7	98,87	98,87	98,87	25,500	31,500	37,800

*Di sini k adalah unit tekanan yang dipengaruhi oleh kecepatan gerakan dan kondisi saat beroperasi. Untuk roda baja $k = 40 \text{ s/d } 60 \text{ kg/cm}^2$ untuk roda besi.



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Table 14/6. Radial bearings. Dimension group 2

All dimensions are in mm C = basic load rating			Deep groove ball bearing			Angular-contact ball bearing			Self-aligning ball bearing																
			DIN 625 (Aug. 1942)			DIN 628 (Aug. 1942)			DIN 630 (Aug. 1942)																
			$P = x \cdot P_r + y \cdot P_a$			$P = x \cdot P_r + y \cdot P_a$			$P = P_r + y \cdot P_a$																
			$x = 1 \quad y = 1,4^1$			$x = 0,5^1$ $x = 0,7$ $y = 0,7$			<table border="1"> <tr> <th>Bearing no.</th> <th>y</th> <th>1206/07</th> <th>3,25</th> </tr> <tr> <td>13300/04</td> <td>2,25</td> <td>1208/09</td> <td>3,5</td> </tr> <tr> <td>1200/03</td> <td>2,5</td> <td>1210/12</td> <td>4,0</td> </tr> <tr> <td>1234/05</td> <td>2,75</td> <td>1213/22</td> <td>4,5</td> </tr> </table>				Bearing no.	y	1206/07	3,25	13300/04	2,25	1208/09	3,5	1200/03	2,5	1210/12	4,0	1234/05
Bearing no.	y	1206/07	3,25																						
13300/04	2,25	1208/09	3,5																						
1200/03	2,5	1210/12	4,0																						
1234/05	2,75	1213/22	4,5																						
d	D	r	Symbol	b	C kgf	Symbol	b	C kgf	Symbol	b	C kgf														
4	16	0,5	R 4	5	140	—	—	—	—	—	—														
5	19		R 5	6	216	—	—	—	133 00	6	166														
7	22		R 7	7	240	—	—	—	02	7	193														
9	26	1	R 9	8	340	—	—	—	04	8	275														
10	30		6200	9	340	QA 10	9	430	1200	9	390														
12	32		01	10	530	12	10	465	01	10	415														
15	35		02	11	585	15	11	540	02	11	570														
17	40	1,5	03	12	720	17	12	735	03	12	640														
20	47		04	14	980	20	14	1 120	04 (1 b)	14	830														
25	52		05 c	15	1 040	25	15	1 270	05 (1 b)	15	1020														
30	62		06	16	1 460	30	16	1 560	06 (1 b)	16	1400														
35	72	2	07	17	1 960	35	17	1 900	07 (1 b)	17	1530														
40	80		08	18	2 240	40	18	2 280	08 (1 b)	18	1930														
45	85		09	19	2 500	45	19	2 360	09 (1 b)	19	2160														
50	90		6210	20	2 700	50	20	2 450	1210 (1 b)	20	2320														
55	100	2,5	11	21	3 250	55	21	3 150	11 (1 b)	21	2800														
60	110		12	22	4 000	60	22	4 000	12 (1 b)	22	3200														
65	120		13	23	4 400	65	23	4 550	13 (1 b)	23	3450														
70	125		14	24	4 650	70	24	4 750	14 (1 b)	24	3800														
75	130		15	25	5 000	75	25	5 000	15 (1 b)	25	4250														
80	140	3	6216	26	5 500	QA 80	26	5 850	1216 (1 c)	26	4500														
85	150		17	28	6 300	85	28	6 550	17 (1 c)	28	5400														
90	160		18	30	7 100	90	30	7 350	18 (1 c)	30	6000														
95	170	3,5	19	32	8 000	95	32	8 500	19 (1 c)	32	6800														
100	180		20	34	9 000	100	34	9 500	20 (1 c)	34	7350														
105	190		21	36	9 800	105	36	10 600	21 (1 c)	36	8000														
110	200		22	38	10 800	110	38	11 800	22 (1 c)	38	9300														
120	215		24	40	11 000	120	40	12 500	—	—	—														
130	230	4	26	40	12 000	130	40	12 900	—	—	—														
140	250		28	42	12 900	140	42	14 000	—	—	—														
150	270		30	45	13 700	150	45	16 600	—	—	—														
160	290		32	48	14 600	160	48	18 600	—	—	—														
170	310	5	34	52	17 000	170	52	21 200	—	—	—														
180	320		36	52	18 300	180	52	22 000	—	—	—														
190	340		38	55	20 800	190	55	23 600	—	—	—														
200	360		40	58	22 000	200	58	26 500	—	—	—														
220	400		44	65	24 500	—	—	—	—	—	—														
240	440		48	72	30 000	—	—	—	—	—	—														
260	480	6	52	80	34 000	—	—	—	—	—	—														
280	500		56	80	36 000	—	—	—	—	—	—														

¹The small values of x are applicable for peripheral load, the large ones for point load for the inner race.

²Belongs to dimension group 2 (light series).



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Cylindrical roller bearing					Self-aligning bearing			Angular-contact bearing			Self-aligning bearing		
DIN 5412 (Aug. 1942)					DIN 635 (Aug. 1942)			DIN 628 (Aug. 1942)			DIN 635 (Aug. 1942)		
$P = z \cdot P_r$					$P = x \cdot P_r + y \cdot P_a$			$P = x \cdot P_r + y \cdot P_a$			$P = x \cdot P_r + y \cdot P_a$		
$x = 1,1$ $x = 1,4$					$x = 1,1$ $x = 1,4$ $y = 9,5$			$x = 1,1$ $x = 1,4$ $y = 1,3$			$x = 1$ $x = 1,4$		
											Bearing no. y		
											22216/17 4,6		
											22218/20 4,4		
											22222/56 4,2		
Symbol	Symbol	b	r _i	C kgf	Symbol	b	C kgf	Symbol	b	C kgf	Symbol	b	C kgf
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	3200x	14,0	695	—	—	—
—	—	—	—	—	—	—	—	01x	15,9	780	—	—	—
—	—	—	—	—	—	—	—	02x	15,9	780	—	—	—
—	—	—	—	—	—	—	—	03x	17,5	1 100	—	—	—
UL 20	NIL 20	14	1	980	—	—	—	04x	20,6	1 530	—	—	—
25	25	15	—	1 100	20205	15	1 500	05x	20,6	1 730	—	—	—
30	30	16	—	1 460	06	16	1 730	06x	23,8	2 500	—	—	—
35	35	17	—	2 120	07	17	2 500	07x	27,0	3 350	—	—	—
40	40	18	2	2 750	08	18	3 000	08x	30,2	3 800	—	—	—
45	45	19	—	2 930	09	19	3 200	09x	30,2	4 250	—	—	—
50	50	20	—	3 050	20210	20	3 750	10x	30,2	4 750	—	—	—
55	55	21	—	3 650	11	21	4 750	11x	33,3	5 400	—	—	—
60	60	22	2,5	4 400	12	22	5 500	12x	36,5	6 550	—	—	—
65	65	23	—	5 100	13	23	6 200	13x	38,1	7 100	—	—	—
70	70	24	—	5 300	14	24	7 100	14x	39,7	7 100	—	—	—
75	75	25	—	6 200	15	25	7 600	15x	41,3	7 800	—	—	—
UL 80	NIL 80	28	3	7 100	20216	26	8 500	3216x	44,4	9 500	22216 (k)	33	9 500
85	85	28	—	8 150	17	28	10 000	17x	49,2	10 200	17 (k)	36	12 200
90	90	30	—	9 800	18	30	12 000	18x	52,4	11 800	18 (k)	40	15 600
95	95	32	3,5	11 400	19	32	14 000	19x	55,6	13 700	19 (k)	43	18 300
100	100	34	—	12 700	20	34	15 600	20x	60,3	14 600	20 (k)	46	21 200
105	105	36	—	14 000	21	36	16 600	21x	65,1	15 300	—	—	—
110	110	38	—	16 300	22	38	19 600	22x	69,8	17 300	22 (k)	53	27 500
120	120	40	—	18 300	24	40	21 600	—	—	—	24 (k)	58	34 000
130	130	40	4	19 000	26	40	23 200	—	—	—	26 (k)	64	42 500
140	140	42	—	22 400	28	42	27 500	—	—	—	28 (k)	68	48 000
150	150	45	—	27 000	30	45	31 000	—	—	—	30 (k)	73	54 000
160	160	48	—	31 000	32	48	35 500	—	—	—	32 (k)	80	65 500
170	170	52	5	35 500	34	52	42 500	—	—	—	34 (k)	86	73 500
180	180	52	—	36 500	36	52	47 500	—	—	—	36 (k)	86	75 000
190	190	55	—	41 500	38	55	51 000	—	—	—	38 (k)	92	83 000
200	200	58	—	45 500	40	58	55 000	—	—	—	40 (k)	98	93 000
220	220	65	—	57 000	44	65	67 000	—	—	—	44 (k)	103	118 000
240	240	72	—	72 000	48	72	81 500	—	—	—	48 (k)	120	146 000
260	260	80	6	88 000	52	80	98 000	—	—	—	52 (k)	130	170 000
280	280	80	—	88 000	56	80	100 000	—	—	—	56 (k)	130	180 000



Table 14/7. Radial bearings

			Deep-groove ball bearing			Angular-contact bearing			Self-aligning bearing														
			DIN 625 (Aug. 1942)			DIN 628 (Aug. 1942)			DIN 630 (Aug. 1942)														
All dimensions are in mm																							
C = basic load rating			$P = x \cdot P_r + y \cdot P_a$			$P = x \cdot P_r + y \cdot P_a$			$P = P_r + y \cdot P_a$														
			$x = 1,0 \quad x = 1,4^1$			$x = 0,5^1$ $x = 0,7$ $y = 0,7$			<table border="1"> <tr> <th>Bearing no.</th> <th>y</th> <th>1306/09</th> <th>3,0</th> </tr> <tr> <td>1300/03</td> <td>2,25</td> <td>1310/13</td> <td>3,25</td> </tr> <tr> <td>1304/05</td> <td>2,75</td> <td>1314/22</td> <td>3,5</td> </tr> </table>			Bearing no.	y	1306/09	3,0	1300/03	2,25	1310/13	3,25	1304/05	2,75	1314/22	3,5
Bearing no.	y	1306/09	3,0																				
1300/03	2,25	1310/13	3,25																				
1304/05	2,75	1314/22	3,5																				
			<table border="1"> <tr> <th>C : P_a</th> <th>5</th> <th>10</th> <th>20</th> <th>40</th> </tr> <tr> <th>y</th> <td>1,4</td> <td>1,6</td> <td>1,8</td> <td>2,0</td> </tr> </table>			C : P _a	5	10	20	40	y	1,4	1,6	1,8	2,0								
C : P _a	5	10	20	40																			
y	1,4	1,6	1,8	2,0																			
d	D	r	Symbol	b	C kgf	Symbol	b	C kgf	Symbol	b	C kgf												
10	35	1	6300	11	655	QB 10	11	695	1300	11	520												
12	37	1,5	01	12	800	12	12	850	01	12	680												
15	42		02	13	880	15	13	915	02	13	735												
17	47		03	14	1 060	17	14	1 080	03	14	965												
20	52	2	04	15	1 250	20	15	1 270	04 (k)	15	1 020												
25	62		05	17	1 660	25	17	1 560	05 (k)	17	1 500												
30	72		06	19	2 200	30	19	2 200	06 (k)	19	1 860												
35	80	2,5	07	21	2 600	35	21	2 750	07 (k)	21	2 280												
40	90		08	23	3 150	40	23	3 200	08 (k)	23	2 750												
45	100		09	25	4 050	45	25	3 900	09 (k)	25	3 450												
50	110	3	10	27	4 750	50	27	4 500	10 (k)	27	3 900												
55	120		11	29	5 400	55	29	5 300	11 (k)	29	4 750												
60	130	3,5	12	31	6 100	60	31	6 100	12 (k)	31	5 500												
65	140		13	33	6 950	65	33	6 800	13 (k)	33	5 850												
70	150		14	35	7 800	70	35	7 800	14 (k)	35	6 950												
75	160		15	37	8 500	75	37	8 300	15 (k)	37	7 350												
80	170		16	39	9 300	80	39	9 000	16 (k)	39	8 150												
85	180	4	17	41	10 200	85	41	10 000	17 (k)	41	9 150												
90	190		18	43	11 000	90	43	11 000	18 (k)	43	10 400												
95	200		19	45	12 000	95	45	12 200	19 (k)	45	11 600												
100	215	4	6320	47	13 700	QB 100	47	13 700	1320 (k)	47	12 500												
105	225		21	49	14 600	105	49	15 300	21 (k)	49	14 000												
110	240		22	50	16 600	110	50	16 300	22 (k)	50	15 300												
120	260		24	55	16 600	120	55	18 600	—	—	—												
130	280	5	26	58	18 600	130	58	20 000	—	—	—												
140	300		28	62	20 800	140	62	22 400	—	—	—												
150	320		30	65	22 400	150	65	25 000	—	—	—												
160	340		32	68	22 800	—	—	—	—	—	—												
170	360		34	72	26 500	—	—	—	—	—	—												
180	380		36	75	30 000	—	—	—	—	—	—												
190	400	6	38	78	31 000	—	—	—	—	—	—												
200	420		40	80	32 000	—	—	—	—	—	—												
220	460		44	88	34 500	—	—	—	—	—	—												
240	500		48	95	37 500	—	—	—	—	—	—												
260	540	8	52	102	42 500	—	—	—	—	—	—												
280	580		56	108	48 000	—	—	—	—	—	—												
—	—		—	—	—	—	—	—	—	—	—												
—	—		—	—	—	—	—	—	—	—	—												
—	—		—	—	—	—	—	—	—	—	—												
—	—		—	—	—	—	—	—	—	—	—												

¹The small values of x are applicable for peripheral load, the large ones for point load for the inner race.



Table 14/8. Radial

Dimension group 2 (light series)

All dimensions are in mm

C = basic load rating

Taper roller bearing										Taper roller bearing					
DIN 720 (Aug 1942)										DIN 720 (Aug. 1942)					
$P > P_r$	$x = 0,5^1$	Bearing no.	y	$P > P_r$		$x = 0,5^1$		$y = 1,6$							
$P \leq P_r$	$x = 1^1$			30203/04	1,8	$P \leq P_r$						$x = 1^1$			
$P > 1,4 P_r$	$x = 0,7^2$	30205/22	1,6	$P > 1,4 P_r$		$x = 0,7^2$									
$P \leq 1,4 P_r$	$x = 1,4^2$	30224/30	1,4	$P \leq 1,4 P_r$		$x = 1,4^2$									

d	D	r	r_1	Symbol	b_i	b_a	B		C	Symbol	b_i	b_a	F		C
							max	min	kgf				max	min	kgf
15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
17	40	1,5	0,5	30203	12	11	13,5	13	1 040	—	—	—	—	—	—
20	47	—	—	04	14	12	15,5	15	1 600	—	—	—	—	—	—
25	52	—	—	05	15	13	16,5	16	1 760	—	—	—	—	—	—
30	62	—	—	06	16	14	17,5	17	2 400	32206	20	17	21,5	21	3 250
35	72	2	0,8	07	17	15	18,5	18	3 100	07	23	19	24,5	24	4 300
40	80	—	—	08	18	16	20	19,5	3 600	08	23	19	25	24,5	4 800
45	85	—	—	09	19	16	21	20,5	4 150	09	23	19	25	24,5	5 200
50	90	—	—	10	20	17	22	21,5	4 550	10	23	19	25	24,5	5 300
55	100	2,5	—	11	21	18	23	22,5	5 600	11	25	21	27	26,5	6 950
60	110	—	—	12	22	19	24	23,5	6 100	12	28	24	30	29,5	8 300
65	120	—	—	13	23	20	25	24,5	7 200	13	31	27	33	32,5	10 000
70	125	—	—	14	24	21	26,5	26	7 800	14	31	27	33,5	33	10 200
75	130	—	—	15	25	22	27,5	27	8 650	15	31	27	33,5	33	10 800
80	140	3	1	16	26	22	28,5	28	9 650	16	33	28	35,5	35	12 500
85	150	—	—	17	28	24	31	30	11 400	17	36	30	39	38	14 300
90	160	—	—	18	30	26	33	32	12 700	18	40	34	43	42	17 300
95	170	3,5	1,2	19	32	27	35	34	14 000	19	43	37	46	45	19 600
100	180	—	—	20	34	29	37,5	36,5	16 300	20	46	39	49,5	48,5	22 000
105	190	—	—	21	36	30	39,5	38,5	18 300	21	50	43	53,5	52,5	25 500
110	200	—	—	22	38	32	41,5	40,5	20 400	22	53	46	56,5	55,5	28 500
120	215	—	—	24	40	34	44	43	22 800	24	58	50	62	61	34 000
130	230	4	1,5	26	40	34	44,5	43	24 500	—	—	—	—	—	—
140	250	—	—	28	42	36	46,5	45	28 500	—	—	—	—	—	—
150	270	—	—	30	45	38	50	48	32 500	—	—	—	—	—	—

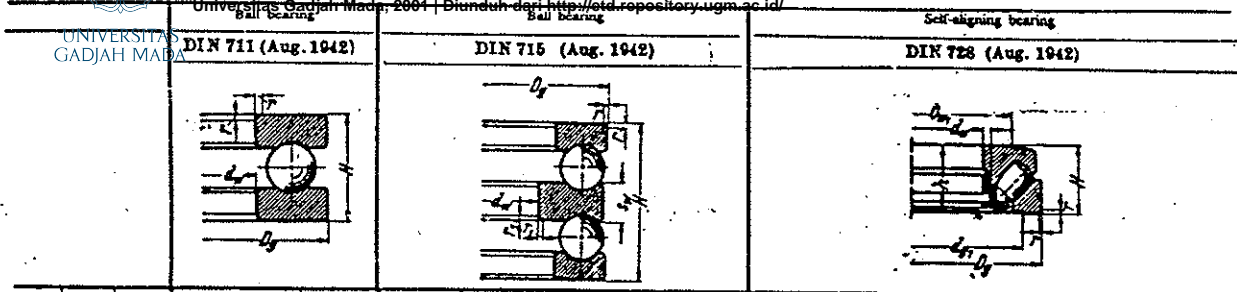
¹Is applicable for peripheral load for the inner race. If hereby with $x = 0,5$, $P < P_r$, then instead of $x = 0,5$ the value $x = 1$, $y = 0$ should be used.

²Is applicable for the point load for inner race. If hereby $x = 0,7$, $P < 1,4 P_r$, then instead of $x = 0,7$ the value $x = 1,4$ and $y = 0$ should be used.



Perancangan Deep Drawn Pan Conveyor (Clinker Transport Kapasitas 500 Ton / Jam)
 Pamuji, Ir. Chairil Hidayat
 Ball bearing, dimension group 2 (light series)

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DIN 711 (Aug. 1942)			DIN 715 (Aug. 1942)					Self-aligning bearing DIN 728 (Aug. 1942)										
d_w D	D_g	r	Symbol	H	C kgf	Symbol	d_w	H	d_w	r ₁	C kgf	Symbol	D_{w1}	$\angle g_1$	H	A	C kgf	
10	26	1	51200	11	720	—	—	—	—	—	—	—	—	—	—	—	—	—
12	28		01	14	780	—	—	—	—	—	—	—	—	—	—	—	—	—
15	32		02	12	950	52202	10	22	5	0,5	950	—	—	—	—	—	—	—
17	35		03	12	1000	—	—	—	—	—	—	—	—	—	—	—	—	—
20	40		04	14	1400	04	15	26	6	0,5	1400	—	—	—	—	—	—	—
25	47		05	15	1800	05	20	28	7		1800	—	—	—	—	—	—	—
30	53		06	16	1960	06	25	29	7		1960	—	—	—	—	—	—	—
35	62	1,5	07	18	2650	07	30	34	8		2650	—	—	—	—	—	—	—
40	68		08	19	3060	08	30	36	9	1	3050	—	—	—	—	—	—	—
45	73		09	20	3250	09	35	37	9		3250	—	—	—	—	—	—	—
50	78		10	22	3450	10	40	39	9		3450	—	—	—	—	—	—	—
55	90		11	25	4900	11	45	45	10		4900	—	—	—	—	—	—	—
60	95		12	26	5300	12	50	46	10		5300	—	—	—	—	—	—	—
65	100		13	27	5500	13	55	47	10		5500	—	—	—	—	—	—	—
70	105		14	27	5700	14	55	47	10	1,5	5700	—	—	—	—	—	—	—
75	110		15	27	5850	15	60	47	10		5850	—	—	—	—	—	—	—
80	115		16	28	6100	16	65	48	12		6100	—	—	—	—	—	—	—
85	125		17	31	7200	17	70	55	14		7200	—	—	—	—	—	—	—
90	135	2	18	35	8650	18	75	62	15		8650	—	—	—	—	—	—	—
100	150		20	38	10800	20	85	67	15		10800	—	—	—	—	—	—	—
110	160		22	38	11400	22	95	67	15		11400	—	—	—	—	—	—	—
120	170		24	39	11800	24	100	68	18	2	11800	—	—	—	—	—	—	—
130	190	2,5	51226	45	15000	26	110	80	18		15000	—	—	—	—	—	—	—
140	200		28	46	15600	28	120	81	20		15600	—	—	—	—	—	—	—
150	215	2,5	30	50	17000	52230	130	89	20	2	17000	—	—	—	—	—	—	—
160	225		32	51	17600	32	140	90	20		17600	—	—	—	—	—	—	—
170	240		34	55	20000	34	150	97	21		20000	—	—	—	—	—	—	—
180	250		36	56	20800	36	150	98	21	3	20800	—	—	—	—	—	—	—
190	270	3	38	62	24500	38	160	109	24		24500	—	—	—	—	—	—	—
200	280		40	62	25000	40	170	109	24		25000	—	—	—	—	—	—	—
220	300		44	63	26500	44	190	110	24		26500	—	—	—	—	—	—	—
240	340	3,5	48	78	34500	—	—	—	—	—	—	29248	285	305	60	57	68000	—
260	360		52	79	36500	—	—	—	—	—	—	52	305	325	60	57	72000	—
280	380		56	80	38000	—	—	—	—	—	—	56	325	345	60	57	75000	—
300	420	4	60	95	49000	—	—	—	—	—	—	50	355	380	73	69	95000	—
320	440		64	95	51000	—	—	—	—	—	—	64	375	400	73	69	98000	—
340	460		68	96	52000	—	—	—	—	—	—	68	395	420	73	69	102000	—
360	500	5	72	110	64000	—	—	—	—	—	—	72	420	455	85	81	129000	—
380	520		—	—	—	—	—	—	—	—	—	76	440	475	85	81	134000	—
400	540		—	—	—	—	—	—	—	—	—	80	460	490	85	81	140000	—
420	580	6	—	—	—	—	—	—	—	—	—	84	490	525	95	91	186000	—
440	600		—	—	—	—	—	—	—	—	—	88	510	545	95	91	193000	—
460	620		—	—	—	—	—	—	—	—	—	92	530	570	95	91	200000	—
480	650		—	—	—	—	—	—	—	—	—	96	555	595	103	99	220000	—
500	670		—	—	—	—	—	—	—	—	—	292/500	575	615	103	99	228000	—
530	710		—	—	—	—	—	—	—	—	—	/530	610	650	109	105	250000	—
560	750		—	—	—	—	—	—	—	—	—	/560	645	690	115	111	290000	—
600	800		—	—	—	—	—	—	—	—	—	/600	690	735	122	117	315000	—
630	850	8	—	—	—	—	—	—	—	—	—	/630	730	780	132	127	375000	—
670	900		—	—	—	—	—	—	—	—	—	/670	775	825	140	135	415000	—
710	950		—	—	—	—	—	—	—	—	—	/710	820	870	145	140	455000	—
750	1000		—	—	—	—	—	—	—	—	—	/750	860	915	150	144	500000	—
800	1080	10	—	—	—	—	—	—	—	—	—	800	915	975	155	140	540000	—

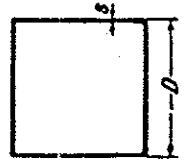


Perancangan Deep Drawn Pan Conveyor (Clinker Transport Kapasitas 500 Ton / Jam)

Pamuji, Ir. Gregorius Harjanto

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Table 5/31. Steel tubes



Dimensions mm		P cm ³	G kg/m	J cm ⁴	W cm ³	t cm			
D**	s***								
Seamless steel tubes (round). Line and structural pipes to DIN 2448 (Jan. 1940)									
38	2,5	2,79	2,19	4,41	2,32	1,26			
41,5*	2,5	3,06	2,40	5,85	2,82	1,38			
44,5	2,5	3,30	2,59	7,30	3,28	1,49			
47,5*	2,5	3,53	2,77	8,97	3,78	1,60			
51	2,5	3,81	2,99	11,2	4,40	1,72			
54	2,5	4,04	3,18	13,4	4,98	1,82			
57	2,75	4,68	3,68	17,3	6,07	1,92			
60	3	5,37	4,22	21,9	7,29	2,02			
63,5	3	5,70	4,48	26,2	8,24	2,14			
70	3	6,31	4,96	35,5	10,1	2,37			
76	3	6,88	5,40	45,9	12,1	2,58			
83	3,25	8,14	6,39	64,8	15,6	2,83			
89	3,25	8,75	6,87	80,6	18,1	3,04			
95	3,5	10,1	7,90	105	22,2	3,24			
102	3,75	11,6	9,09	140	27,4	3,48			
108	3,75	12,3	9,64	167	30,9	3,70			
114*	3,75	13,0	10,2	198	34,7	3,90			
121	4	14,7	11,5	252	41,6	4,14			
127*	4	15,5	12,1	293	46,1	4,44			
133	4	16,2	12,7	338	50,8	4,57			
140*	4,5	19,2	15,0	440	62,9	4,79			
146	4,5	20,3	15,7	501	68,7	4,96			
152	4,5	20,8	16,4	567	74,8	5,22			
159	4,5	21,8	17,2	652	82,0	5,47			
165*	4,5	22,7	17,8	731	88,6	5,68			
171	4,5	23,5	18,5	824	96,4	5,92			
178*	5	27,2	21,3	1020	114	6,12			
191	5,5	32,0	25,2	1380	145	6,56			
203*	5,5	34,1	26,8	1670	179	6,99			
216	6,5	42,8	33,6	2350	218	7,41			
229*	6,5	45,4	35,7	2820	246	7,87			
241	6,5	47,9	37,6	3300	273	8,30			
254*	6,5	50,5	39,7	3870	305	8,75			
267	7	57,2	44,9	4840	362	9,20			
279*	7,5	63,9	50,2	5900	423	9,61			
292	7,5	67,0	52,6	6800	466	10,08			
305*	7,5	70,1	55,0	7760	509	10,52			
318	8	77,9	61,2	9370	589	10,97			
square tubes welded									
50-30	2	2,98	2,40	10,1	4,55	4,06	3,03	1,84	1,23
60-50	3	6,06	4,88	30,7	23,2	10,2	9,27	2,26	1,95
89	3,75	12,6	9,9	149		33,5		3,44	
101,5	5	19,0	14,9	278		56,5		3,88	

* These sizes are not preferred.

** Pipes with $D < 38$ mm and $D > 318$ mm are also available.

*** These pipes are available with other wall thicknesses.

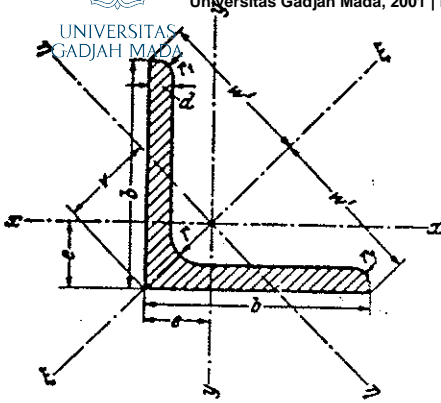


Table 5/33. Equal angles
 Usual lengths = 3 to 15 m,
 profile factor $k_f = F^2/J \approx 6$ (mean)

The axis $\xi - \xi$ bisects the angle

Symbol	Dimensions mm				F cm ²	G kg/m	Distances of axis cm			For the axis of bending						Rivet holes to DIN 997 (April 1927)			
	b	d	r	r ₁			e	e'	v	x-x=y-y			$\xi-\xi$		$\eta-\eta$		d ₁ mm	w mm	
										J _x =J _y cm ⁴	W _x =W _y cm ³	i _x =i _y cm	J _ξ cm ⁴	i _ξ cm	J _η cm ⁴	W _η cm ³			i _η cm
Equal angles to DIN 1028 sheet 1 (July 1940)																			
20-20-3 4	20	3	3,5	2	1,12 1,45	0,88 1,14	0,80 0,84	1,41	0,85 0,90	0,39 0,48	0,28 0,35	0,59 0,58	0,62 0,77	0,74 0,73	0,15 0,19	0,18 0,21	0,37 0,36	—	—
25-25-3 (4) 5	25	3	3,5	2	1,42 1,85 2,26	1,12 1,45 1,77	0,78 0,78 0,80	1,77	1,03 1,08 1,13	0,79 1,01 1,18	0,45 0,58 0,69	0,75 0,74 0,72	1,27 1,61 1,87	0,95 0,93 0,91	0,31 0,40 0,50	0,30 0,37 0,44	0,47 0,47 0,47	—	—
30-30-3 4 5	30	3	3	2,5	1,74 2,27 2,78	1,38 1,78 2,18	0,84 0,89 0,92	2,12	1,18 1,24 1,30	1,41 1,61 2,16	0,65 0,86 1,04	0,90 0,89 0,88	2,24 2,85 3,41	1,14 1,12 1,11	0,57 0,76 0,91	0,48 0,61 0,70	0,57 0,61 0,57	8,5	17
35-35-4 5 6	35	4	5	2,5	2,67 3,28 3,87	2,10 2,57 3,04	1,00 1,04 1,08	2,47	1,41 1,47 1,53	2,96 3,56 4,14	1,18 1,45 1,71	1,05 1,04 1,04	4,68 5,63 6,50	1,33 1,31 1,30	1,24 1,49 1,77	0,88 1,01 1,16	0,68 0,67 0,68	11	20
40-40-4 5 6	40	4	6	3	3,08 3,79 4,48	2,42 2,97 3,52	1,12 1,18 1,20	2,83	1,58 1,64 1,70	4,48 5,43 6,38	1,56 1,91 2,26	1,21 1,20 1,19	7,09 8,64 9,98	1,52 1,51 1,49	1,86 2,22 2,67	1,18 1,35 1,57	0,78 0,77 0,77	11	22
45-45-5 (7)	45	5	7	3,5	4,30 5,86	3,38 4,60	1,28 1,36	3,18	1,81 1,92	7,83 10,4	2,43 3,31	1,35 1,33	12,4 16,4	1,70 1,67	3,25 4,39	1,80 2,29	0,87 0,87	11	25
50-50-5 6 7 9	50	5	7	3,5	4,80 5,69 6,56 8,24	3,77 4,47 5,15 6,47	1,40 1,45 1,48 1,56	3,54	1,98 2,04 2,11 2,21	11,0 12,8 14,6 17,9	3,05 3,61 4,15 5,20	1,51 1,50 1,49 1,47	17,4 20,4 23,1 28,1	1,90 1,89 1,88 1,85	4,59 5,24 6,02 7,67	2,32 2,57 2,85 3,47	0,98 0,96 0,96 0,97	14	30
55-55-6 8 (10)	55	6	8	4	6,31 8,23 10,1	4,95 6,46 7,90	1,56 1,64 1,72	3,89	2,21 2,32 2,43	17,3 22,1 26,3	4,40 5,72 6,97	1,66 1,64 1,62	27,4 34,8 41,4	2,08 2,06 2,02	7,24 9,35 11,3	3,28 4,03 4,65	1,07 1,07 1,03	17	30
60-60-6 8 10	60	6	8	4	8,91 9,03 11,1	5,42 7,09 8,69	1,69 1,77 1,85	4,24	2,39 2,50 2,62	22,8 29,1 34,9	5,29 6,88 8,41	1,82 1,20 1,78	36,1 46,1 56,1	2,29 2,26 2,23	9,43 12,1 14,6	3,95 4,84 5,57	1,17 1,16 1,15	17	35
65-65-7 9 11	65	7	9	4,5	8,70 11,0 13,2	6,83 8,62 10,3	1,85 1,93 2,00	4,60	2,62 2,73 2,83	33,4 41,3 48,8	7,18 9,04 10,8	1,96 1,94 1,91	53,0 65,4 78,8	2,47 2,44 2,42	13,8 17,2 20,7	5,27 6,50 7,31	1,26 1,25 1,25	20	35
70-70-7 9 11	70	7	9	4,5	9,40 11,9 14,3	7,33 9,34 11,2	1,97 2,05 2,13	4,95	2,79 2,90 3,01	42,4 52,6 61,8	8,43 10,6 12,7	2,12 2,10 2,08	67,1 83,1 97,6	2,67 2,64 2,61	17,6 22,0 26,0	6,31 7,59 8,64	1,37 1,36 1,35	20	40
75-75-7 8 10 12	75	7	10	5	10,1 11,5 14,1 16,7	7,94 9,03 11,1 13,1	2,09 2,13 2,21 2,29	5,30	2,95 3,01 3,12 3,24	52,4 58,9 71,4 82,4	9,67 11,0 13,5 15,8	2,28 2,26 2,25 2,22	83,6 93,3 113 130	2,88 2,85 2,83 2,79	21,1 23,4 29,8 34,7	7,15 8,11 9,55 10,7	1,45 1,46 1,45 1,44	23	40

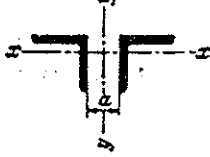
Rivet pitch for equal angles: DIN 999, sheets 1 and 2 (July 1927)

Sizes within brackets are not preferred.

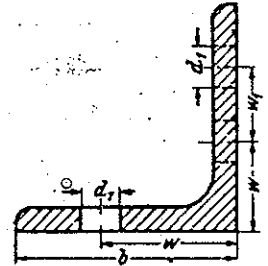


Perancangan Deep Drawn Pan Conveyor (Clinker Transport Kapasitas 500 Ton / Jam)
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1 row of rivets for b up to 100 mm
 2 rows of staggered rivets for $b > 100$ mm



For any distance a the principal moment of inertia referred to $y-y$ axis is greater than the principal moment of inertia referred to $x-x$ axis.

Symbol	Dimensions mm				F cm ²	G kg/m	Distances of axis cm			For the axis of bending						Rivet holes to DIN 997 (April 1927)				
	b	d	r	r ₁			e	w'	e	x-x=y-y			ξ-ξ		η-η			d ₁ mm	w mm	v ₁ mm
										J _x -J _y cm ⁴	W _x -W _y cm ³	i _x -i _y cm	J _ξ cm ⁴	i _ξ cm	J _η cm ⁴	W _η cm ³	i _η cm			
Equal angles to DIN 1028 sheet 2 (July 1941)																				
80-80-8	8				12,3	9,66	2,20													
10	10				15,1	11,9	2,34	5,66	3,20	72,3	12,6	2,42	115	3,06	29,6	9,25	1,55			
12	12	10	6		17,9	14,1	2,41		3,31	87,5	15,5	2,41	139	3,03	35,9	10,9	1,54	23	45	
14	14				20,6	16,1	2,48		3,41	102	18,2	2,39	161	3,00	43,0	12,6	1,53			
					20,6	16,1	2,48		3,61	115	20,8	2,36	181	2,96	48,6	13,9	1,54			
90-90-9	9				15,5	12,2	2,54		3,59	116	18,0	2,74	184	3,45	47,8	13,3	1,70			
11	11				18,7	14,7	2,62	6,36	3,70	138	21,6	2,72	218	3,41	57,1	15,4	1,75			
13	13	11	3,5		21,8	17,1	2,70		3,81	158	25,1	2,69	250	3,39	65,9	17,3	1,74	26	50	
16	16				26,4	20,7	2,81		3,97	186	30,1	2,66	294	3,34	79,1	19,9	1,73			
100-100-10	10				19,2	15,1	2,82		3,99	177	24,7	3,04	280	3,82	73,3	18,4	1,95			
12	12				22,7	17,8	2,90	7,07	4,10	207	29,2	3,02	328	3,80	80,2	21,0	1,95			
14	14	12	6		26,2	20,6	2,98		4,21	235	33,5	3,00	372	3,77	98,3	23,4	1,94	26	55	
16	16				29,6	23,2	3,06		4,32	262	37,7	2,97	413	3,74	111	25,6	1,93			
110-110-10	10				21,2	16,6	3,07		4,34	239	30,1	3,36	379	4,23	98,6	22,7	2,16			
12	12	10	6		25,1	19,7	3,15	7,78	4,45	280	35,7	3,34	444	4,21	116	26,1	2,15	26	45	
14	14				29,0	22,8	3,21		4,54	319	41,0	3,32	505	4,18	133	29,3	2,14		25	
130-130-11	11				25,4	19,9	3,36		4,75	341	39,5	3,66	541	4,62	140	29,5	2,35			
13	13				29,7	23,3	3,44		4,86	394	46,0	3,64	625	4,59	162	33,3	2,34			
15	15	13	6,5		33,9	26,6	3,51	8,49	4,96	446	52,5	3,63	705	4,56	186	37,5	2,34	26	50	
(17)	17				38,1	29,9	3,59		5,08	493	58,7	3,60	778	4,51	208	41,0	2,34		30	
130-130-12	12				30,0	23,6	3,64		5,15	472	50,4	3,97	750	5,00	194	37,7	2,54			
14	14	130	14	7	34,7	27,2	3,72	9,19	5,26	540	58,2	3,94	857	4,97	223	42,4	2,53	26	50	
16	16				39,3	30,9	3,80		5,37	605	65,8	3,92	959	4,94	251	46,7	2,52		40	
140-140-13	13				35,0	27,5	3,92		5,54	638	60,3	4,27	1010	5,38	262	47,3	2,74			
15	15	140	15	7,5	40,0	31,4	4,00	9,90	5,66	723	72,3	4,25	1150	5,36	298	52,7	2,73	28	55	
(17)	17				45,0	35,3	4,08		5,77	805	81,2	4,23	1280	5,33	334	57,9	2,72		45	
160-150-14	14				40,3	31,6	4,21		5,95	845	78,2	4,58	1340	5,77	347	58,3	2,94			
16	16	150	16	8	45,7	35,9	4,29	10,6	6,07	949	88,7	4,56	1510	5,74	391	64,4	2,93	26	55	
18	18				51,0	40,1	4,36		6,17	1050	99,3	4,54	1670	5,70	438	71,0	2,93		55	
180-180-15	15				46,1	36,2	4,49		6,35	1100	95,6	4,88	1750	6,15	453	71,3	3,14			
17	17	160	17	8,5	51,8	40,7	4,57	11,3	6,46	1230	108	4,86	1950	6,13	506	78,3	3,13	29	30	
19	19				57,5	45,1	4,65		6,58	1350	118	4,84	2140	6,10	558	84,8	3,12		55	
180-180-16	16				55,4	43,5	5,02		7,11	1680	130	5,51	2690	6,96	679	95,5	3,50			
18	18	180	18	9	61,9	48,6	5,10	12,7	7,22	1870	145	5,49	2970	6,93	767	105	5,49	29	60	
20	20				68,4	53,7	5,18		7,33	2040	160	5,47	3260	6,90	830	113	3,49		75	
200-200-16	16				61,8	48,5	5,52		7,80	2340	162	6,15	3740	7,78	943	121	3,91			
18	18	200	18	9	69,1	54,3	5,60	14,1	7,92	2600	181	6,13	4150	7,75	1050	133	3,90	32	60	
20	20				76,4	59,9	5,68		8,04	2850	199	6,11	4540	7,72	1160	144	3,89		90	

Rivet pitch for equal angles: DIN 999, sheets 1 and 2 (July 1927).

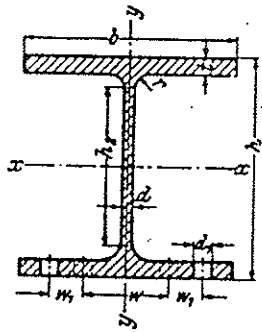


Perancangan Deep Drawn Pan Conveyor (Clinker Transport Kapasitas 500 Ton / Jam)
 Pamuji, Ir. Gregorius H. Santoso, Broad flange and parallel flange I steel

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Usual lengths = 4 to 15 m

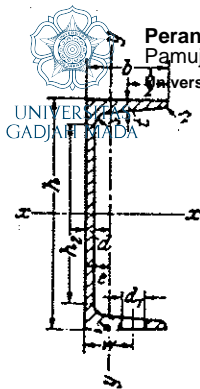
(can be delivered up to 25 m and more with prior notice)



$b = h$ for profile \leq I P 30
 $b = 300$ mm for profile \geq I P 30

Designation	Dimension mm						F cm ²	G kg/m	For the axis of bending						For the flange holes DIN 996 (April 1927)			Designation	
	h	b	d	t	r	λ_1			x-x			y-y			a_1 mm	s_0 mm	s_1 mm		
									J_x cm ⁴	W_x cm ³	i_x cm	J_y cm ⁴	W_y cm ³	i_y cm					
IP	Broad flange and parallel flange I steel to DIN 1025, sheet 2 (July 1940*)																		IP
(10)	100	100	6,5	10	10	60	26,1	20,5	447	89,3	4,14	167	33,4	2,53	17	54	—	(10)	
12	120	120	8	11	11	76	34,6	27,2	852	142	4,96	276	46,0	2,82	17	64	—	12	
14	140	140	8	12	12	85	44,1	34,6	1520	217	5,87	550	78,8	3,53	20	80	—	14	
18	180	180	9	14	14	120	65,8	51,8	3830	426	7,63	1360	151	4,55	26	100	—	18	
20	200	200	10	16	15	140	82,7	64,9	5950	595	8,48	2140	214	6,08	26	110	—	20	
22	220	220	10	16	15	160	91,1	71,5	8050	732	9,37	2840	258	5,59	26	120	—	22	
24	240	240	11	18	17	170	111	87,4	11690	974	10,3	4160	346	6,11	26	90	35	24	
26	260	260	11	18	17	190	121	94,8	15050	1160	11,2	5280	466	6,81	26	100	40	26	
28	280	280	12	20	18	200	144	113	20720	1480	12,0	7320	523	7,14	26	110	45	28	
30	300	300	12	20	18	220	154	121	25780	1720	12,9	9010	600	7,65	26	120	50	30	
32	320	300	13	22	20	230	171	135	32250	2020	13,7	9910	661	7,60	26	120	50	32	
34	340	300	13	22	20	250	174	137	36940	2170	14,5	9910	661	7,55	26	120	50	34	
36	360	300	14	24	21	270	192	150	45120	2510	15,3	10810	721	7,51	26	120	50	36	
38	380	300	14	24	21	290	194	153	50950	2680	16,2	10810	721	7,46	26	120	50	38	
40	400	300	14	26	21	300	209	164	60640	3030	17,0	11710	781	7,49	26	120	50	40	
(42½)	425	300	14	26	21	330	212	166	69480	3270	18,1	11710	781	7,43	26	120	50	(42½)	
45	450	300	15	28	23	350	232	182	84220	3740	19,0	12620	841	7,38	26	120	50	45	
(47½)	475	300	15	28	23	370	235	185	95120	4010	20,1	12620	841	7,32	26	120	50	(47½)	
50	500	300	16	30	24	390	255	200	113200	4530	21,0	13530	902	7,28	26	120	50	50	
55	550	300	16	30	24	440	263	207	140300	5100	23,1	13530	902	7,17	26	120	50	55	
60	600	300	17	32	26	480	289	227	180800	6030	25,0	14440	962	7,07	26	120	50	60	
65	650	300	17	32	26	530	297	234	216800	6670	27,0	14440	962	6,97	26	120	50	65	
70	700	300	18	34	27	580	324	254	270300	7720	28,9	15350	1020	6,88	26	120	50	70	
(75)	750	300	18	34	27	630	333	261	316300	8430	30,8	15350	1020	6,79	26	120	50	(75)	
80	800	300	18	34	27	680	342	268	366400	9160	32,7	15350	1020	6,70	26	120	50	80	
90	900	300	19	36	30	770	381	299	506000	11250	36,4	16270	1080	6,53	26	120	50	90	
(95)	950	300	19	36	30	820	391	307	573000	12060	38,3	16270	1080	6,45	26	120	50	(95)	
100	1000	300	19	36	30	870	400	314	644700	12900	40,1	15280	1080	6,37	26	120	50	100	

Sizes within the brackets are not preferred.



Perancangan Deep Drawn Conveyor (Clinker Transport Kapasitas 500 Ton / Jam)

Pamuji, Ir. Gregorius Harjanto

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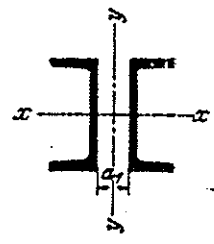
Table 5/35 Steel
Usual lengths = 4 to 15 m

Scope of the inner surface of flange
= 8% for sizes \leq 30
= 5% for sizes $>$ 30
Except for 38 (slope 2°)

a_1 = Distance between webs of two sections for which both the principal moments of inertia are same and equal to $2J_x$

e = Distance of the centre of gravity axis $y'-y'$

Profile factor $k_l = F^2/J \approx 7$



Designation	Dimensions mm						F cm ²	G kg/m	For the axis of bending						e cm	a ₁ mm	For the flange holes DIN 997 (April 1927)		Designation
	h	b	d	t=r	r ₁	λ ₁			x-x			y-y					d ₁ mm	s ₀ mm	
									J _x cm ⁴	W _x cm ³	i _x cm	J _y cm ⁴	W _y cm ³	i _y cm					
C-Steel to DIN 1026, sheet 1 (July 1940*)																			
(3)	30	33	5	7	3,5	—	5,44	4,27	6,39	4,26	1,08	5,33	2,68	0,99	1,31	—	—	—	(3)
4	40	35	5	7	3,5	—	6,21	4,87	14,1	7,05	1,50	6,68	3,08	1,04	1,33	—	1,2	20	4
5	50	38	5	7	3,5	—	7,12	5,59	26,4	10,6	1,92	9,12	3,75	1,13	1,37	4	1,2	20	5
6½	65	42	5,5	7,5	4	—	9,03	7,09	57,5	17,7	2,52	14,1	5,07	1,25	1,42	16	1,2	25	6½
8	80	45	6	8	4	45	11,0	8,64	106	26,5	3,10	19,4	6,36	1,33	1,45	28	1,4	25	8
10	100	50	6	8,5	4,5	65	13,5	10,6	206	41,2	3,91	29,3	8,49	1,47	1,55	42	1,4	30	10
12	120	55	7	9	4,5	80	17,0	13,4	364	60,7	4,62	43,2	11,1	1,59	1,60	56	1,7	30	12
14	140	60	7	10	5	100	20,4	16,0	605	86,4	5,45	62,7	14,8	1,75	1,75	70	1,7	35	14
16	160	65	7,5	10,5	5,5	110	24,0	18,8	825	116	6,21	85,3	18,3	1,89	1,84	82	2,0	36	16
18	180	70	8	11	5,5	130	28,0	22,0	1350	150	6,95	114	22,4	2,02	1,92	96	2,0	40	18
20	200	75	8,5	11,5	6	150	32,2	25,3	1910	191	7,70	148	27,0	2,14	2,01	108	2,3	40	20
22	220	80	9	12,5	6,5	160	37,4	29,4	2690	245	8,48	197	33,6	2,30	2,14	122	2,3	45	22
24	240	85	9,5	13	6,5	180	42,3	33,2	3600	300	9,22	248	39,6	2,42	2,23	134	2,6	45	24
26	260	90	10	14	7	200	48,3	37,9	4820	371	9,99	317	47,7	2,56	2,36	146	2,6	50	26
(28)	280	95	10	15	7,5	220	53,3	41,8	6280	448	10,9	399	57,2	2,74	2,53	160	2,6	50	(28)
30	300	100	10	16	8	230	58,8	46,2	8030	535	11,7	495	67,8	2,90	2,70	174	2,6	55	30
(32)	320	100	14	17,5	8,75	240	75,8	59,5	10870	679	12,1	597	80,6	2,81	2,60	182	2,6	55	(32)
35	350	100	14	16	8	280	77,3	60,6	12840	734	12,9	570	75,0	2,72	2,40	204	2,6	55	35
(38)	381	102	13,34	16	11,2	310	79,7	62,6	15730	826	14,1	613	78,4	2,78	2,35	230	2,6	55	(38)
40	400	110	14	18	9	320	91,5	71,8	20350	1020	14,9	846	102	3,04	2,65	240	2,6	60	40
C-Steel for the steel lattice constructions, to DIN 1026, sheet 1 (July 1940*)																			
F 14	140	40	4	6	3	110	9,9	7,78	285	40,6	5,36	12,5	4,21	1,12	1,02	—	11	22	F 14
C-Steel for wagon building, to DIN 1026, sheet 2 (July 1940*)																			
76	76	55	10	11,15	5,6	—	17,6	13,8	142	37,3	2,84	45,1	12,7	1,60	1,95	8	—	—	76
(80 30)	80	30	8	8	4	—	11,5	9,02	97	21,2	2,91	18,2	4,90	1,26	1,25	28	—	—	(80 30)
(50)	80	50	8	8	4	—	11,5	9,02	97	21,2	2,91	18,2	4,90	1,26	1,25	28	—	—	(80 50)
91,5	91,5	26,5	8,5	10,7	5,35	—	11,8	9,27	119	26,0	3,18	5,40	3,00	0,68	0,85	45	—	—	91,5
26,5	91,5	26,5	8,5	10,7	5,35	—	11,8	9,27	119	26,0	3,18	5,40	3,00	0,68	0,85	45	—	—	26,5
105	105	65	8	8	4	70	17,3	13,6	287	54,7	4,07	61,2	13,2	1,88	1,88	36	—	—	105
65	105	65	8	8	4	70	17,3	13,6	287	54,7	4,07	61,2	13,2	1,88	1,88	36	—	—	65
145	145	60	8	8	4	110	19,8	15,6	585	80,7	5,43	53,6	11,9	1,65	1,50	74	—	—	145
60	145	60	8	8	4	110	19,8	15,6	585	80,7	5,43	53,6	11,9	1,65	1,50	74	—	—	60
235	235	90	10	12	6	180	42,4	33,3	3430	292	9,00	272	40,5	2,53	2,28	128	—	—	235
90	235	90	10	12	6	180	42,4	33,3	3430	292	9,00	272	40,5	2,53	2,28	128	—	—	90
300	300	75	10	10	5	240	42,8	33,6	4930	328	10,7	145	24,2	1,84	1,50	182	—	—	300
75	300	75	10	10	5	240	42,8	33,6	4930	328	10,7	145	24,2	1,84	1,50	182	—	—	75
(300)	300	78	10	13	6,5	240	47,6	37,4	5860	393	11,1	209	34,7	2,10	1,80	182	—	—	(300)
(78)	300	78	10	13	6,5	240	47,6	37,4	5860	393	11,1	209	34,7	2,10	1,80	182	—	—	(78)

Sizes within the brackets are not preferred.